Appendix B2

Native American Correspondence

Table B2-1. Forbes ANGS Government-to-Government Consultation

Tribe	Point of Contact(s)	Consultation Letters Sent (Yes/No)	Response Received (Yes/No)	Concurrence (Yes/No)	Comment/Follow-Up
Delaware Nation	Tamara Francis, THPO 31064 US Highway 281, Bldg. 100, Anadarko, OK 73005 Kerry Holton, President Delaware Nation PO Box 825, Anadarko, OK 73005	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.
Prairie Band of Potawatomi Tribe	Steve Ortiz, Chairperson Prairie Band of Potawatomi Tribe, 16281 Q Rd, Mayetta, KS 66509	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.
Citizen Potawatomi Nation	Kelli Mosteller, THPO 1601 S Gordon Cooper Dr, Shawnee, OK 74801 John Barrett, Chairman 1601 S Gordon Cooper Dr Shawnee, OK 74801	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.
Eastern Shawnee Tribe of Oklahoma	Glenna Wallace, Chief 12755 S 705 Rd, Wyandotte, OK 74370	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.
Kaw Nation	Guy Munroe, Chairman Kaw Nation, Drawer 50, Kaw City, OK 74641	Yes	Yes	Yes	Consultation Completed via telephone call.
Osage Nation of Oklahoma	Andrea Hunter, THPO Osage Nation of Oklahoma 627 Grandview, Pawhuska, OK 74056 John Redeagle, Principal Chief PO Box 779, 627 Grandview Pawhuska, OK 74056	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.
Absentee Shawnee Tribe of Oklahoma	George Blanchard 2025 S Gordon Cooper Dr, Shawnee, OK 74801 Henryetta Ellis, THPO 2025 S Gordon Cooper Dr, Shawnee, OK 74801	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.
Wichita and Affiliated Tribes	Leslie Standing, President PO Box 729, Anadarko, OK 73005	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.

Table B2-2. JB MDL Government-to-Government Consultation

Tribe	Point of Contact(s)	Consultation Letters Sent (Yes/No)	Response Received (Yes/No)	Concurrence (Yes/No)	Comment/Follow-Up
Delaware Tribe of Indians	Brice Obermeyer, THPO Department of Sociology and Anthropology, Emporia State University, Roosevelt Hall, Rm 212, 1200 Commercial St, Emporia, KS 66801 Paula Pechonick, Chief 170 NE Barbara St, Bartlesville, OK 74006 Chester Brooks, Trust Board Chairman 170 NE Barbara St, Bartlesville, OK 74006	Yes	Yes	Yes	Consultation Completed
Delaware Nation	Tamara Francis, THPO 31064 US Highway 281, Bldg. 100, Anadarko, OK 73005 Kerry Holton, President PO Box 825, Anadarko, OK 73005	Yes	No	Response pending	E-mailed on 11/22/13 and telephoned on 11/22/13 and left message.
Stockbridge-Munsee Community	Sherry White, THPO, N8476 Mo He Con Nuck Road, Bowler, WI 54416	Yes	Yes	Yes	Consultation Completed

Table B2-3. Pease ANGS Government-to-Government Consultation

Tribe	Point of Contact(s)	Consultation Letters Sent (Yes/No)	Response Received (Yes/No)	Concurrence (Yes/No)	Comment/Follow-Up
Penobscot Indian Nation	Kirk Francis, Tribal Chief 12 Wabanaki Way, Indian Island, ME 04668 Bonnie Newsom, THPO 12 Wabanaki Way, Indian Island, ME 04468	Yes	Yes	Yes	Consultation Completed via telephone call.

Table B2-4. Pittsburgh ANGS Government-to-Government Consultation

Tribe	Point of Contact(s)	Consultation Letters Sent (Yes/No)	Response Received (Yes/No)	Concurrence (Yes/No)	Comment/Follow-Up
Cayuga Nation of New York	Melinda Maybee, Nation Representative PO Box 803, Seneca Falls, NY 13148	Yes	Yes	Yes	Consultation Completed via E-mail.
Onondaga Nation of New York	Irving Powless, Chief RRT#1, PO Box 319-B, Nedrow, NY 13120	Yes	Yes	Yes	Consultation Completed via telephone call.
Tuscarora Nation of New York	Leo Henry, Chief 2006 Mt Hope Rd, Lewiston, NY 14092	Yes	No	Response pending	Telephoned on 1/17/14, no answer, not accepting messages; E-mailed on 1/22/14
Seneca Nation of Indians	Robert Odawi Porter, President 12837 Rte. 438, Irving, NY 14081 Lana Watt, THPO 90 Ohiyo Way, Salamanca, NY 14779	Yes	Yes	Yes	Consultation Completed
Tonawanda Band of Seneca	Roger Hill, Chief 7027 Meadville Rd, Basom, NY 14013	Yes	No	Response pending	E-mailed on 1/17/14 and telephoned on 1/17/14 and left message. E-mailed again on 1/22/14.

Table B2-5. Rickenbacker ANGS Government-to-Government Consultation

Tribe	Point of Contact(s)	Consultation Letters Sent (Yes/No)	Response Received (Yes/No)	Concurrence (Yes/No)	Comment/Follow-Up
Shawnee Tribe	Ron Sparkman, Chief PO Box 189, Miami, OK 74355 Jodi Hayes, Tribe Administrator PO Box 189, Miami, OK 74355	Yes	No	Yes	Consultation Completed via telephone call.
Forest County Potawatomi Community	Harold Frank, Chairman PO Box 340, Crandon, WI 54520	Yes	No	Response pending	E-mailed on 1/17/14 and telephoned on 1/17/14 and left message.
Hannahville Indian Community	Kenneth Meshigaud, Chairperson N14911 Hannahville B1 Rd, Wilson, MI 49896-9728	Yes	No	Response pending	E-mailed on 1/17/14 and telephoned on 1/17/14, no answer.

Table B2-5. Rickenbacker ANGS Government-to-Government Consultation (continued)

Tribe	Point of Contact(s)	Consultation Letters Sent (Yes/No)	Response Received (Yes/No)	Concurrence (Yes/No)	Comment/Follow-Up
Miami Tribe of Oklahoma	George Strack, THPO PO Box 1326, Miami, OK 74355-1326 Thomas Gamble, Chairperson PO Box 1326, Miami, OK 74355-1326	Yes	No	Response pending	E-mailed on 1/17/14 and telephoned on 1/17/14 and left message.
Ottawa Tribe of Oklahoma	Ethel áá Cooká, Chief PO Box 110, Miami, OK 74355	Yes	No	Response pending	E-mailed on 1/17/14 and telephoned on 1/17/14, no answer.
Peoria Tribe of Indians of Oklahoma	John Froman, Chief PO Box 1527, Miami, OK 74355	Yes	Yes	Yes	Consultation Completed
Pokagon Band of Potawatomi Indians	Matthew Wesaw, Chairman PO Box 180, Dowagiac, MI 49047 Mike Zimmerman, THPO PO Box 180, Dowagiac, MI 49047	Yes	No	Response pending	E-mailed on 1/17/14 and telephoned on 1/17/14 and left message.
Turtle Mountain Band of Chippewa Indians of North Dakota	Kade Ferris, THPO PO Box 900, Belcourt, ND 58316 Merle St. Claire, Chairman PO Box 900, Belcourt, ND 58316	Yes	Yes	Yes	Consultation Completed
Wyandotte Nation	Billy Friend, Chief 64700 E Highway 60, Wyandotte, OK 74370 Sherri Clemons, THPO 64700 E Highway 60, Wyandotte, OK 74370	Yes	No	Response pending	E-mailed on 1/22/14 and telephoned on 1/17/14 and left message.
Delaware Nation	Tamara Francis, THPO 31064 US Highway 281, Bldg. 100, Anadarko, OK 73005 Kerry Holton, President PO Box 825, Anadarko, OK 73005	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.
Prairie Band of Potawatomi Tribe	Steve Ortiz, Chairperson 16281 Q Rd, Mayetta, KS 66509	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.

Table B2-5. Rickenbacker ANGS Government-to-Government Consultation (continued)

Tribe	Point of Contact(s)	Consultation Letters Sent (Yes/No)	Response Received (Yes/No)	Concurrence (Yes/No)	Comment/Follow-Up
Citizen Potawatomi Nation	Kelli Mosteller, THPO 1601 S Gordon Cooper Dr, Shawnee, OK 74801 John Barrett, Chairman 1601 S Gordon Cooper Dr, Shawnee, OK 74801	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.
Eastern Shawnee Tribe of Oklahoma	Glenna Wallace, Chief 12755 S 705 Rd, Wyandotte, OK 74370	Yes	No	Response pending	E-mailed tribe on 11/22/13 and telephoned on 11/22/13 and left message.

The sample tribal letter following was distributed to the list below:

Tamara Francis, THPO, Delaware Nation, 31064 US Highway 281, Bldg. 100, Anadarko, OK 73005
Kerry Holton, President, Delaware Nation, PO Box 825, Anadarko, OK 73005

Forbes, JB MDL, and Rickenbacker Sample Tribal Letter

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

24 September 2013

NGB/A7A

Tamara Francis
THPO
Delaware Nation
31064 US Highway 281
Bldg. 100
Anadarko, OK 73005

Dear Ms. Francis

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified locations for the beddown of a Formal Training Unit (FTU) and the first Main Operating Base (MOB 1*), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second Main Operating Base (MOB 2), which will be led by an Air National Guard (ANG) unit.

Two separate Environmental Impact Statements (EISs) are being prepared for the MOB 1/FTU, and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including Forbes ANGS in Kansas, Rickenbacker ANGS in Ohio, and Joint Base McGuire-Dix-Lakehurst (Attachments 1, 2, 3). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change

* The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

Forbes, JB MDL, and Rickenbacker Sample Tribal Letter

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to the mix of aircraft using the associated airspace; changes to staffing and manpower at the selected location; changes to the number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this action.

At Forbes ANGS, Rickenbacker ANGS, or JB MDL, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher, and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. Therefore, the National Guard Bureau (NGB) anticipates the areas of potential effect (APE) for this action to be limited to the portions of the installations where construction, demolition, and renovation activities would occur (Attachments 4, 5, 6).

At Forbes ANGS, construction includes options for some of the facilities, but in general there would be an addition to Hangar 662; either interior modifications or an addition to Hangar 665; internal renovations to Building 679; and an addition and demolition of fuel hydrants and associated fuel lines on the aircraft parking apron (Attachment 4).

At Rickenbacker ANGS, construction activities would include: additions and renovations to Hangar 885, an addition to Hangar 883, interior renovations to Hangar 888, modifications to the aircraft ramp and taxiway, and addition and demolition of fuel hydrants and associated fuel lines on the aircraft parking apron (Attachment 5).

At JB MDL, the construction activities would include an addition to Hangar 3333, an addition to Hangar 3336, interior renovations to Hangar 3332, construction of a new 6,700 square foot simulator building west of Building 3390, modifications/additions to the existing aircraft ramp and taxiway, and the addition of eight new fuel hydrants and associated fuel lines on the aircraft parking apron (Attachment 6).

The Delaware Nation has been identified as potentially having historic ties to these locations. In accordance with Section 106 of the National Historic Preservation Act (NHPA) (36 Code of Federal Regulations Parts 800.2, 800.3, and 800.4) and in deference to Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments,* the 190th Air Refueling Wing (190 ARW), the 121st Air Refueling Wing (121 ARW), and the 108th Wing (108 WG) would like to initiate government-to-government consultation regarding the aircraft beddown. In May 2013, as part of the NEPA process, a public participation letter was sent informing various Tribes of the Proposed Action and the locations and times of public information and input meetings. This letter reflects an initiation of the NHPA consultation process under Section 106 for the same action.

Forbes, JB MDL, and Rickenbacker Sample Tribal Letter

The 190 ARW, 121 ARW, and 108 WG would like to discuss the proposed undertaking in detail with you, and to understand and consider any comments, concerns, and suggestions you may have. In particular, the NGB requests your input as to the status of any traditional resources or historic properties that may be located in or near the proposed APEs for this undertaking on any of these three installations (see attached maps). All three of these installations have been surveyed for archaeological resources.

At Forbes ANGS, no archaeological resources have been identified (KS ANG 2008). At Rickenbacker ANGS, no archaeological resources were encountered during the recent comprehensive surveys of the installation (National Guard Bureau [NGB] 2007, NGB 2008, Snyder 2007). However, a few decades previous to the 2008 inventory during excavations for Building 911, a multi-component site (33FR2844) was uncovered. Site 33FR2844 consisted of a historic burial and a prehistoric lithic scatter. This site was recommended eligible for inclusion on the NRHP when it was discovered in 1985 (121 ARW 2011). This site is the only known significant archaeological resource present within the boundaries of the ANGS and it is well outside the proposed APE for the undertaking.

At JB MDL, no archaeological resources have been identified within the proposed APE (Headquarters Air Mobility Command [HQ AMC] 1995, AMC 1996, Holmes 1996, Holmes *et al*. 1997, McGuire AFB 2003, Holmes and Goar 1998). Three historic archaeological sites were recommended eligible for inclusion in the National Register of Historic Places (NRHP). These sites are all well outside the proposed APE for this undertaking.

However, within the proposed APEs at each of the three installations or the vicinity of these APEs, there may be other cultural resources, including traditional resources, known to the Delaware Nation that would need to be considered in relation to the proposed undertaking.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 7), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

Please let us know when you would like to meet to discuss the aircraft beddown proposal and your expectations on how we will accomplish the consultations. You may contact 2d Lt Jarrod Brunkow, Environmental Manager for Forbes ANGS, at (785) 861-4402 or jarrod.brunkow@ang.af.mil; or Roger Jones, Environmental Manager for Rickenbacker ANGS, at (614) 492-4110 or roger.jones@ang.af.mil; or Lt Robert Mendez, Environmental Manager for JB MDL, at (609) 754-3718 or robert.mendez@ang.af.mil You also may request an individual or group meeting with your Tribe.

Forbes, JB MDL, and Rickenbacker Sample Tribal Letter

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We look forward to working with the Delaware Nation in the NHPA Section 106 and government-to-government consultation processes.

Sincerely

WILLIAM P. ALBRO, P.E., GS-15
Associate Director, Installations and Mission Support

cc:
2d Lt Jarrod Brunkow, KS ANG
Colonel Ron Krueger, Wing Commander
Colonel James Jones, 121st Wing Commander, OH ANGS
Mr. Roger Jones, OH ANGS
Colonel Kevin Keehn, 108th Wing Commander, JB MDL
Lt Robert Mendez, JB MDL

Attachments:
1. Vicinity Map of Forbes ANGS
2. Vicinity Map of Rickenbacker ANGS
3. Vicinity Map of JB MDL
4. Map of Forbes ANGS Area of Potential Effect
5. Map of Rickenbacker ANGS Area of Potential Effect
6. Map of JB MDL Area of Potential Effect
7. Draft Description of the Proposed Action and Alternatives

References:

121st Air Refueling Wing (121 ARW)
2011 *Integrated Cultural Resources Management Plan.* May 2011.

Air Mobility Command (AMC)
1996 *Inventory of Cold War Properties.* December 1996.

Headquarters Air Mobility Command (HQ AMC)
1995 *An Archaeological and Historical Resources Inventory of McGuire Air Force Base, New Jersey.* Prepared by Moeller, K.L., D.A. Walitschek, M. Greby, and J.F. Hoffecker of the Argonne National Laboratory for McGuire AFB.

Forbes, JB MDL, and Rickenbacker Sample Tribal Letter

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Holmes, Richard D.
1996 *Phase II Testing of Four Historic Sites McGuire Air Force Base Burlington County, New Jersey*. April 1996. Prepared by Mariah Associates, Inc., Albuquerque, New Mexico and Lyndhurst, New Jersey. Prepared for US Air Force/Air Mobility Command, Scott Air Force Base, Illinois.

Holmes, Richard D., Toni R. Goar, and Katherine J. Roxlau
1997 *Phase I Archaeological Survey of Areas 4100 and 4200 McGuire Air Force Base, New Hanover Township, Burlington County, New Jersey*. November 1997. Prepared by TRC Mariah Associates, Inc. Prepared for US Army Corps of Engineers New York District and US Air Force/Air Mobility Command Scott Air Force Base, Illinois.

Holmes, Richard D. and Toni R. Goar
1998 *Phase II Site Testing of Four Historic Site McGuire Air Force Base Burlington County, New Jersey*. January 1998. Prepared by TRC Mariah Associates, Inc. Prepared for US Air Force/Air Mobility Command, Scott Air Force Base.

Joint Base McGuire-Dix-Lakehurst (JB MDL)
2013 *Draft Integrated Cultural Resources Management Plan*. 87 CES/CEAN, JB MDL, New Jersey. January 2013.

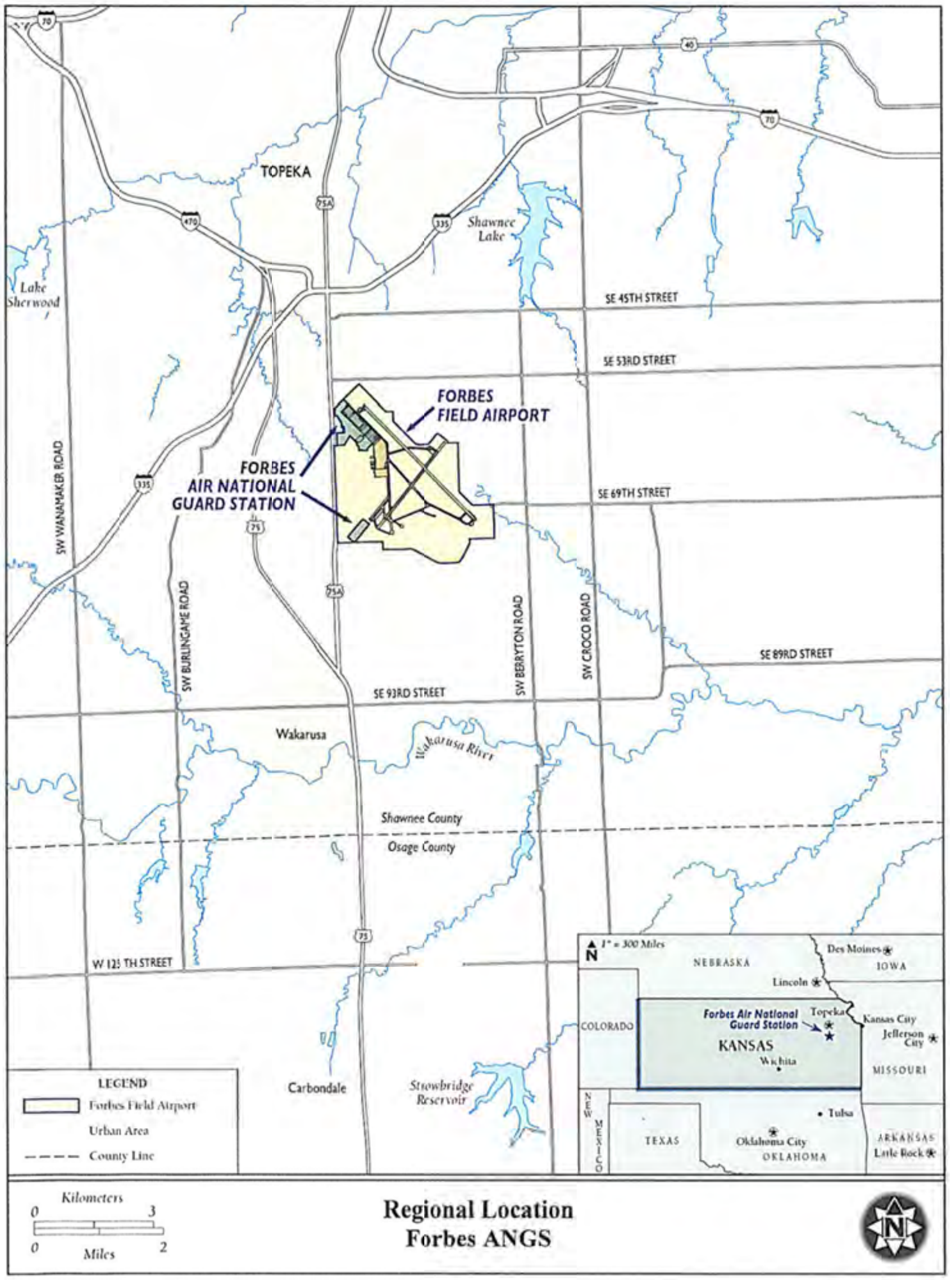
Kansas Air National Guard (KS ANG)
2008 *Cultural Resources Survey and Evaluation Report for Kansas Air National Guard Properties at Forbes Field, Topeka, Kansas.* Prepared for Kansas Air National Guard and Air National Guard, National Guard Bureau. June 2008.

McGuire Air Force Base (AFB)
2003 *Final Integrated Cultural Resources Management Plan*. Prepared 2003. Updated July 2005.

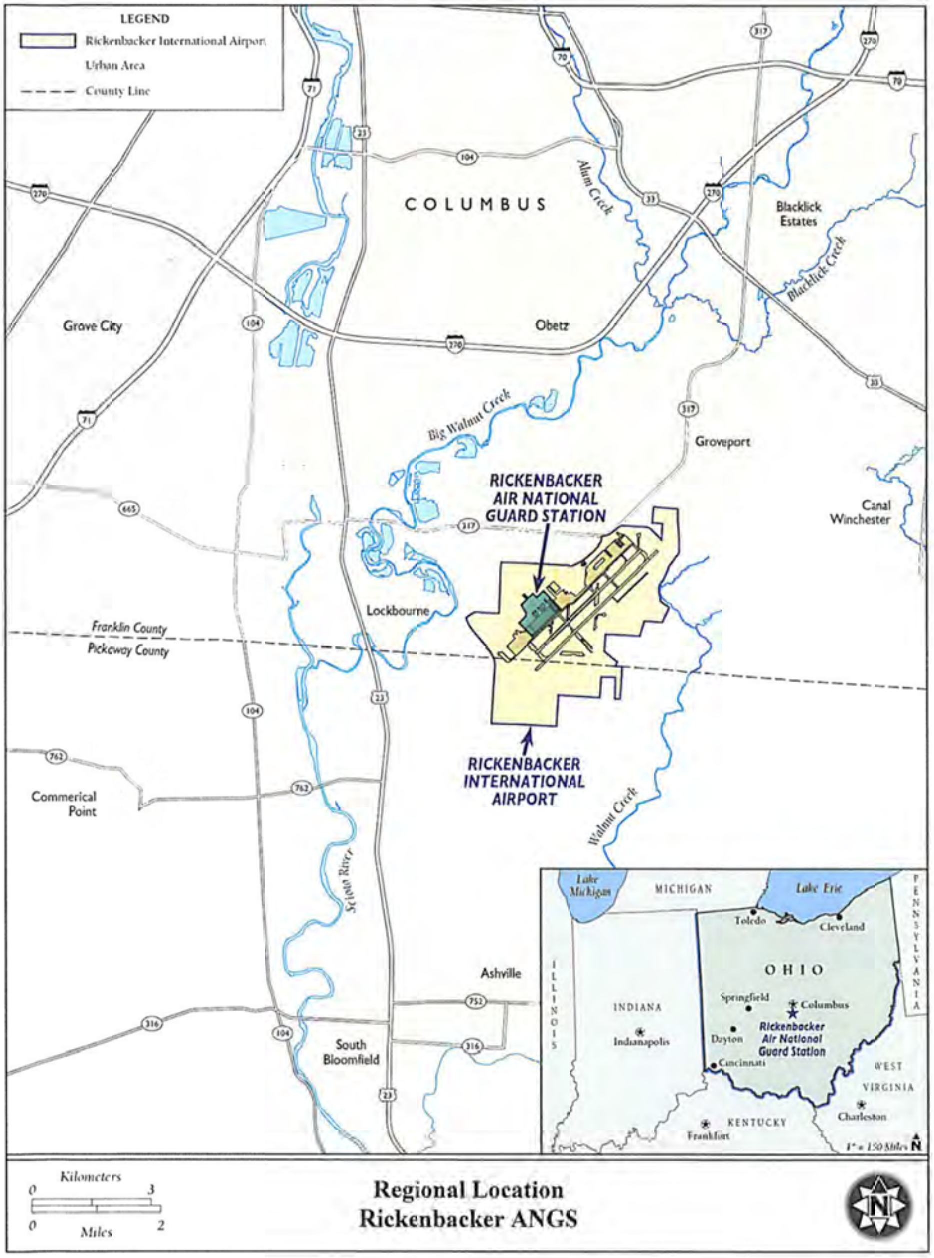
National Guard Bureau (NGB)
2007 *Cultural Resources Survey of the 121st Air Refueling Wing, Ohio Air National Guard, Rickenbacker International Airport, Columbus, Franklin County, Ohio.* Prepared for the National Guard Bureau, Air National Guard Readiness Center NGB/A7CVN, Andrews Air Force Base, Maryland. December 2007.

2008 *Cultural Resources Survey of the 121st Air Refueling Wing, Ohio Air National Guard, Rickenbacker International Airport, Columbus, Franklin County, Ohio.* Prepared for the National Guard Bureau, Air National Guard Readiness Center NGB/A7CVN, Andrews Air Force Base, Maryland. January 2008.

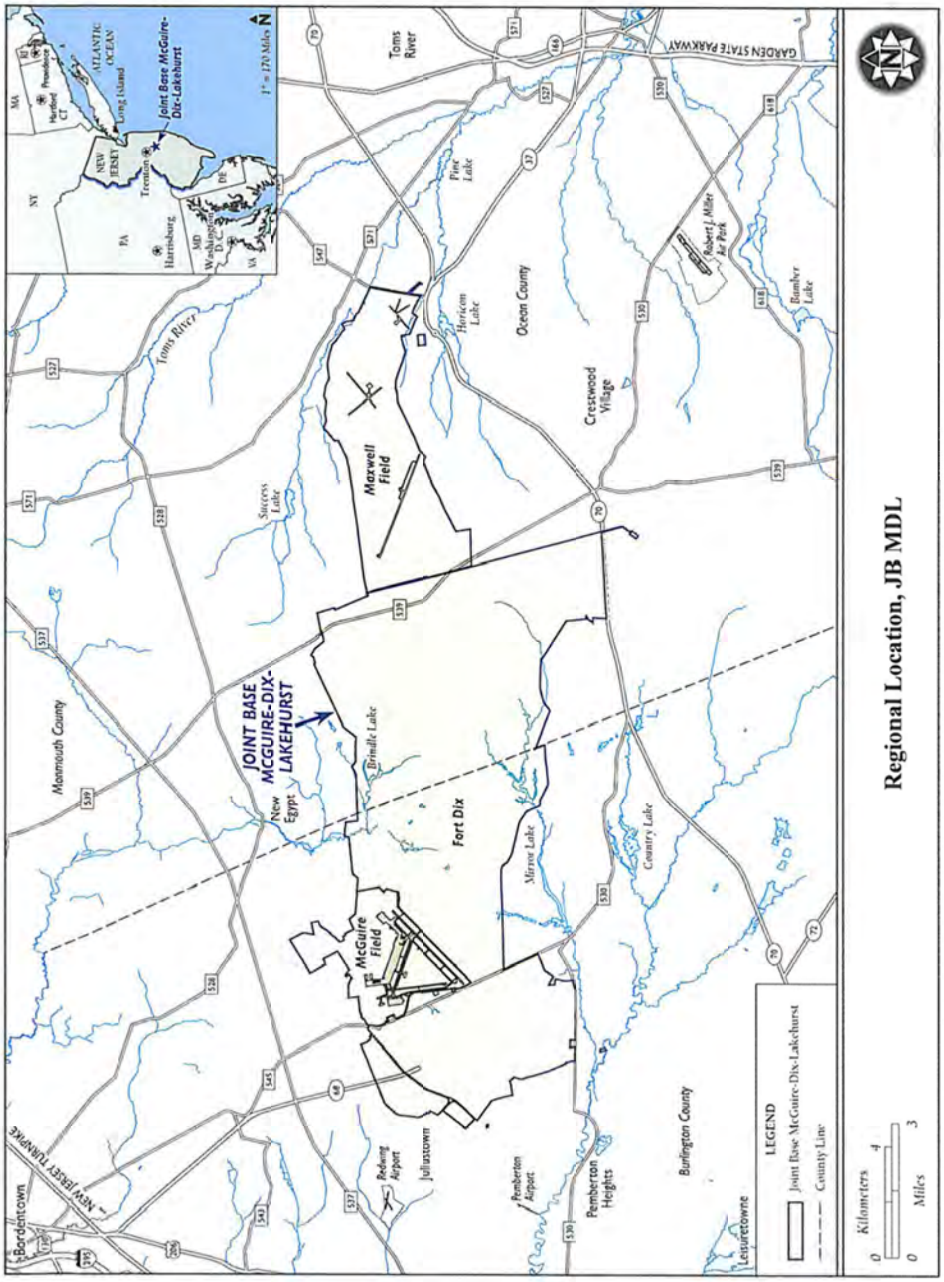
Forbes, JB MDL, and Rickenbacker Sample Tribal Letter



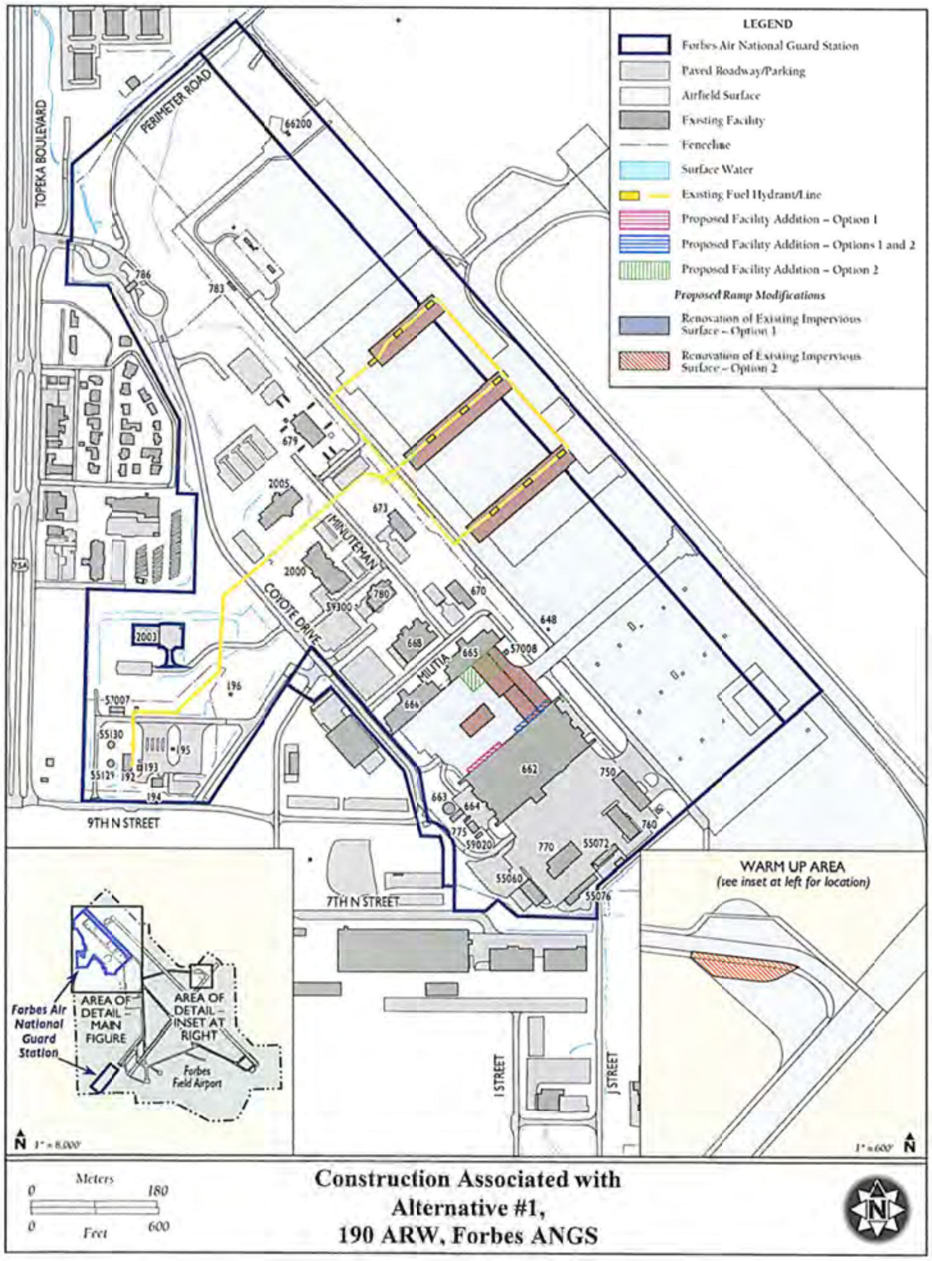
Forbes, JB MDL, and Rickenbacker Sample Tribal Letter



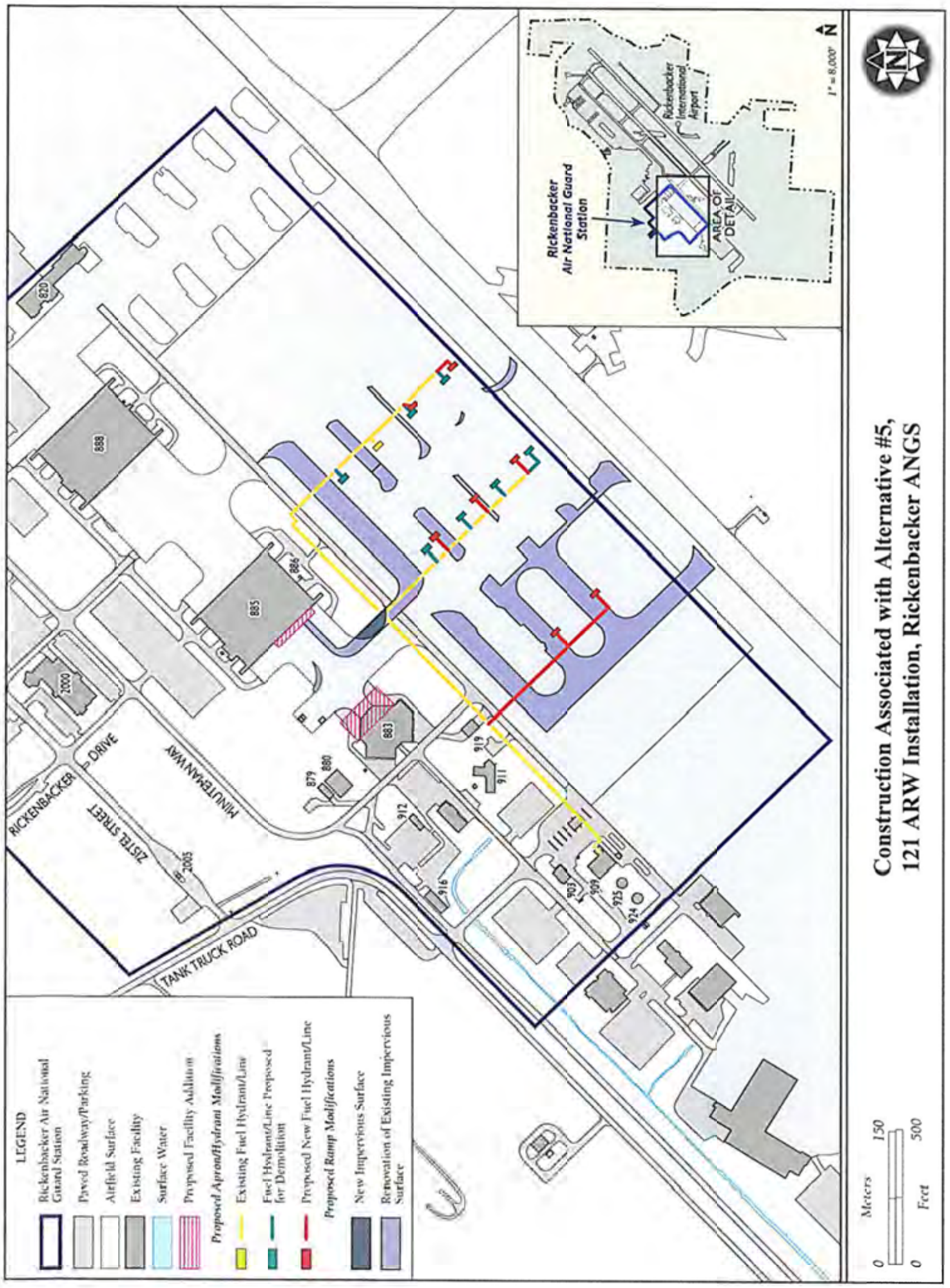
Forbes, JB MDL, and Rickenbacker Sample Tribal Letter



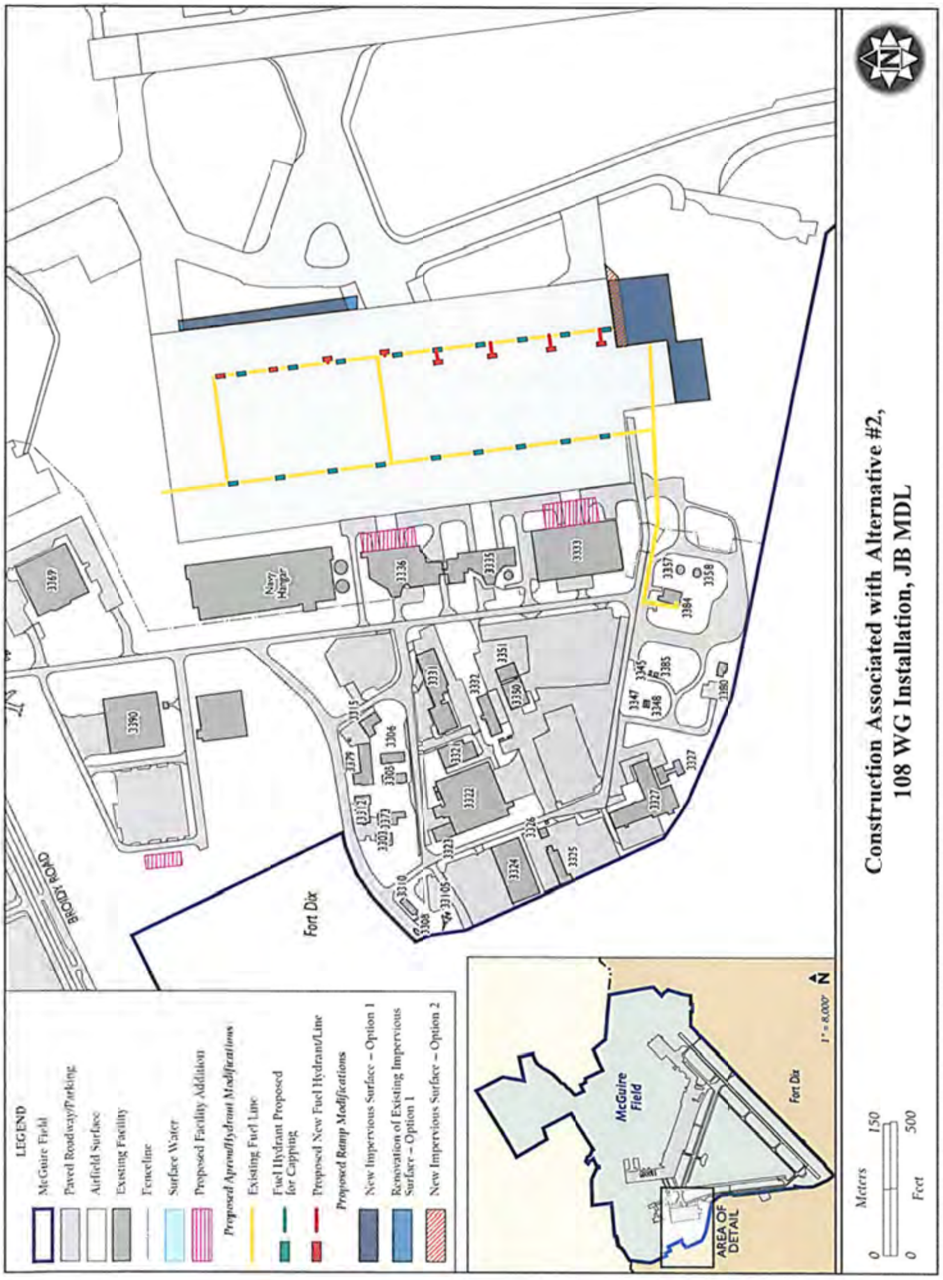
Forbes, JB MDL, and Rickenbacker Sample Tribal Letter



Forbes, JB MDL, and Rickenbacker Sample Tribal Letter



Forbes, JB MDL, and Rickenbacker Sample Tribal Letter



The sample tribal letter following was distributed to the list below:

Steve Ortiz, Chairperson, Prairie Band of Potawatomi Tribe, 16281 Q Rd, Mayetta, KS 66509
Kelli Mosteller, THPO, Citizen Potawatomi Nation, 1601 S Gordon Cooper Dr, Shawnee, OK 74801
John Barrett, Chairman, Citizen Potawatomi Nation, 1601 S Gordon Cooper Dr, Shawnee, OK 74801
Glenna Wallace, Chief, Eastern Shawnee Tribe of Oklahoma, 12755 S 705 Rd, Wyandotte, OK 74370

Forbes and Rickenbacker Sample Tribal Letter

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

24 September 2013

NGB/A7A

Steve Ortiz
Chairperson
Prairie Band of Potawatomi Tribe
16281 Q Rd
Mayetta, KS 66509

Dear Chairperson Ortiz

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified locations for the beddown of a Formal Training Unit (FTU) and the first Main Operating Base (MOB 1*), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second Main Operating Base (MOB 2), which will be led by an Air National Guard (ANG) unit.

Two separate Environmental Impact Statements (EISs) are being prepared for the MOB 1/FTU, and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including both Forbes ANGS in Kansas and Rickenbacker ANGS in Ohio (Attachments 1 and 2). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change to the mix of aircraft using the associated airspace; changes to staffing and manpower at the selected location; changes to the number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this action.

* The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

Forbes and Rickenbacker Sample Tribal Letter

At either Forbes ANGS or Rickenbacker ANGS, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher, and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. Therefore, the National Guard Bureau (NGB) anticipates the areas of potential effect (APE) for this action to be limited to the portions of the installations where construction, demolition, and renovation activities would occur (Attachments 3 and 4).

At Forbes ANGS, construction includes options for some of the facilities, but in general consists of: an addition to Hangar 662; either interior modifications or an addition to Hangar 665; internal renovations to Building 679; and an addition and demolition of fuel hydrants and associated fuel lines on the aircraft parking apron (see Attachment 3).

At Rickenbacker ANGS, construction activities would include: additions and renovations to Hangar 885; an addition to Hangar 883; interior renovations to Hangar 888; modifications to the aircraft ramp and taxiway; and addition and demolition of fuel hydrants and associated fuel lines on the aircraft parking apron (see Attachment 4).

The Prairie Band of Potawatomi Tribe has been identified as potentially having historic ties to these locations. In accordance with Section 106 of the National Historic Preservation Act (NHPA) (36 Code of Federal Regulations Parts 800.2, 800.3, and 800.4) and in deference to Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, the 190th Air Refueling Wing (190 ARW) and the 121st Air Refueling Wing (121 ARW) would like to initiate government-to-government consultation regarding the aircraft beddown. In May 2013, as part of the NEPA process, a public participation letter was sent informing various Tribes of the Proposed Action and the locations and times of public information and input meetings. This letter reflects an initiation of the NHPA consultation process under Section 106 for the same action.

Both Forbes ANGS and Rickenbacker ANGS have been surveyed for archaeological resources. At Forbes ANGS no archaeological resources have been identified (KS ANG 2008). At Rickenbacker ANGS no archaeological resources were encountered during the recent comprehensive surveys of the installation (National Guard Bureau [NGB] 2007, NGB 2008, Snyder 2007). However, a few decades previous to the 2008 inventory during excavations for Building 911, a multi-component site (33FR2844) was uncovered. Site 33FR2844 consisted of a historic burial and a prehistoric lithic scatter. This site was recommended eligible for inclusion on the NRHP when it was discovered in 1985 (121 ARW 2011). This site is the only known significant archaeological resource present within the boundaries of the ANGS and it is well outside the proposed APE for the undertaking. However, within the proposed APEs or the vicinity of these APEs at either ANGS, there may be other cultural resources, including

Forbes and Rickenbacker Sample Tribal Letter

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traditional resources, known to the Prairie Band of Potawatomi Tribe that would need to be considered in relation to the proposed undertaking.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 5), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

The 190 ARW and 121 ARW would like to discuss the proposed undertaking in detail with you, and to understand and consider any comments, concerns, and suggestions you may have. In particular, the NGB requests your input as to the status of any traditional resources or historic properties that may be located in or near the proposed APEs for this undertaking at either of these two installations (see attached maps).

Please let us know when you would like to meet to discuss the aircraft beddown proposal and your expectations on how we will accomplish the consultations. You may contact 2d Lt Jarrod Brunkow, Environmental Manager for Forbes ANGS, at (785) 861-4402 or jarrod.brunkow@ang.af.mil; or Roger Jones, Environmental Manager for Rickenbacker ANGS, at (614) 492-4110 or roger.jones@ang.af.mil. You also may request an individual or group meeting with your Tribe.

We look forward to working with the Prairie Band of Potawatomi Tribe in the NHPA Section 106 and government-to-government consultation processes.

Sincerely

William P. Albro

WILLIAM P. ALBRO, P.E., GS-15
Associate Director, Installations and Mission Support

cc:
2d Lt Jarrod Brunkow, KS ANG
Colonel James Jones, 121st Wing Commander, OH ANG
Mr. Roger Jones, OH ANG
Colonel Ron Krueger, Wing Commander, KS ANG

Forbes and Rickenbacker Sample Tribal Letter

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Attachments:
1. Vicinity map of Forbes ANGS
2. Vicinity map of Rickenbacker ANGS
3. Map of Forbes ANGS Area of Potential Effect
4. Map of Rickenbacker ANGS Area of Potential Effect
5. Draft Description of the Proposed Action and Alternatives

References:

121st Air Refueling Wing (121 ARW)
2011 *Integrated Cultural Resources Management Plan.* May 2011.

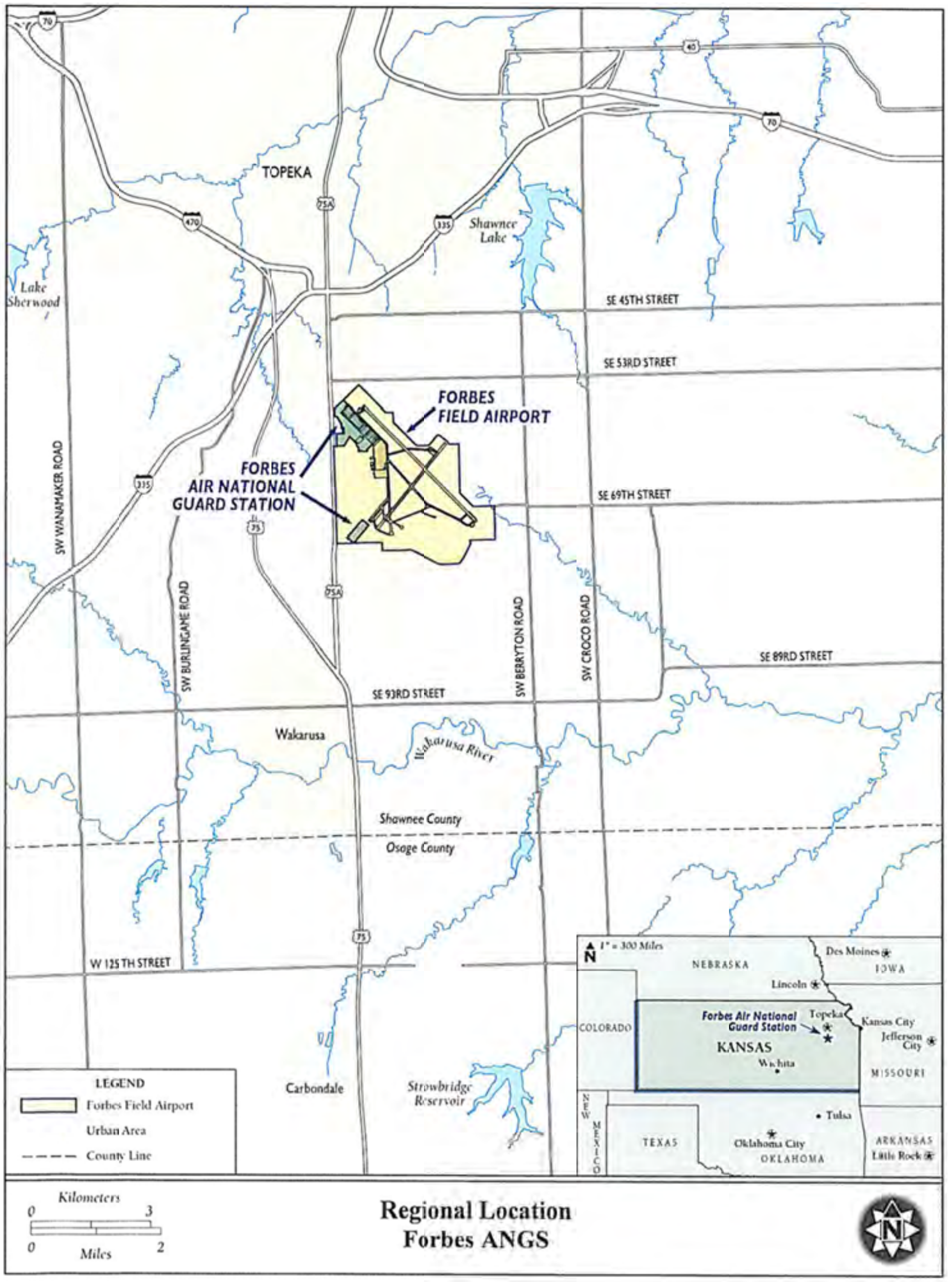
Kansas Air National Guard (KS ANG)
2008 *Cultural Resources Survey and Evaluation Report for Kansas Air National Guard Properties at Forbes Field, Topeka, Kansas.* Prepared for Kansas Air National Guard and Air National Guard, National Guard Bureau. June 2008.

National Guard Bureau (NGB)
2007 *Cultural Resources Survey of the 121st Air Refueling Wing, Ohio Air National Guard, Rickenbacker International Airport, Columbus, Franklin County, Ohio.* Prepared for the National Guard Bureau, Air National Guard Readiness Center NGB/A7CVN, Andrews Air Force Base, Maryland. December 2007.

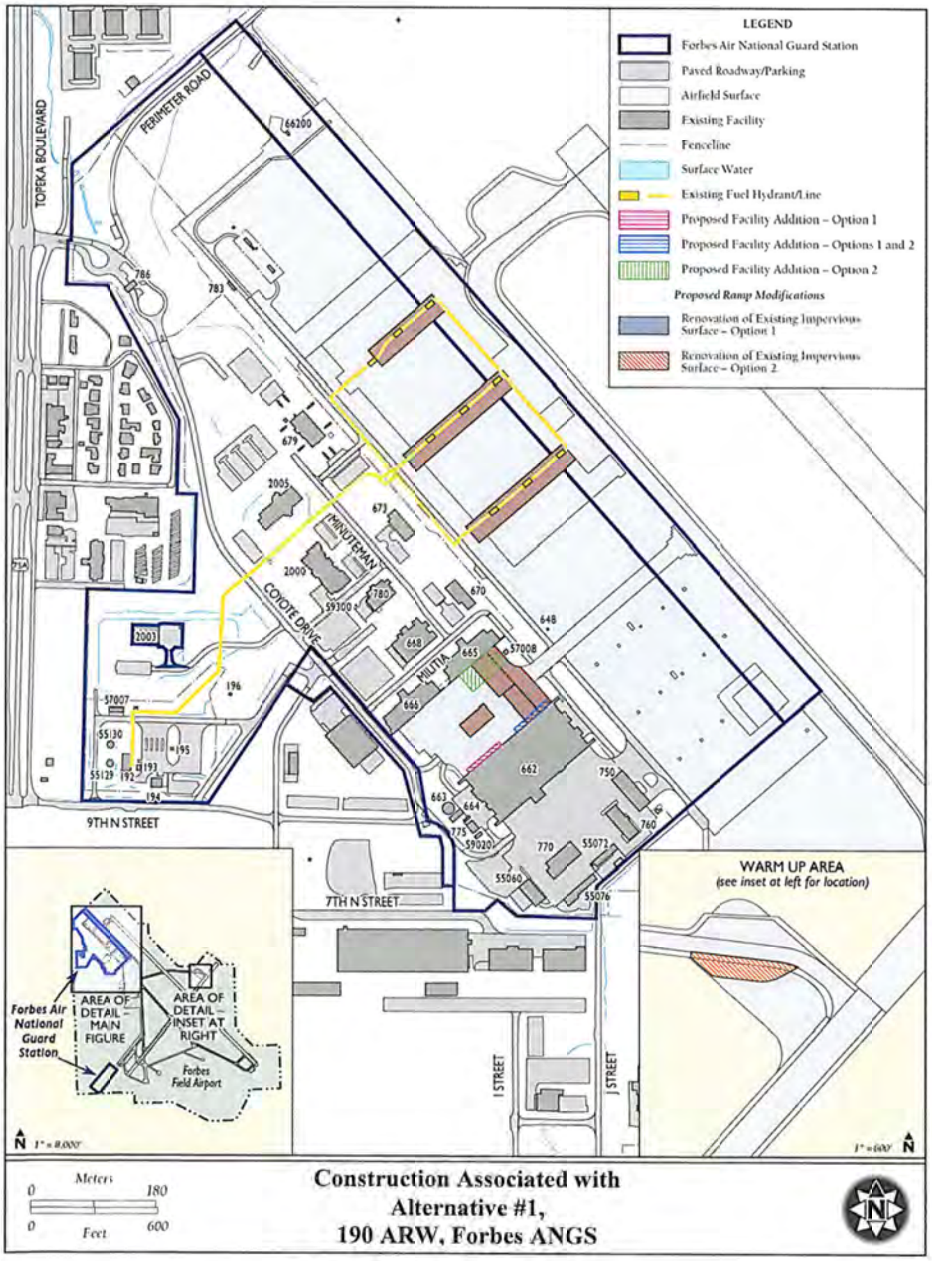
2008 *Cultural Resources Survey of the 121st Air Refueling Wing, Ohio Air National Guard, Rickenbacker International Airport, Columbus, Franklin County, Ohio.* Prepared for the National Guard Bureau, Air National Guard Readiness Center NGB/A7CVN, Andrews Air Force Base, Maryland. January 2008.

Snyder, David
2007 Letter to Matt Nowakowski, National Guard Bureau from David Snyder, Archaeology Review Manager, Resource Protection and Review, Ohio Historic Preservation Office regarding: *121 ARW Ohio ANG, Rickenbacker IAP, Draft Final Cultural Resources Survey, Hamilton Township, Franklin County, Ohio.* August 23, 2007.

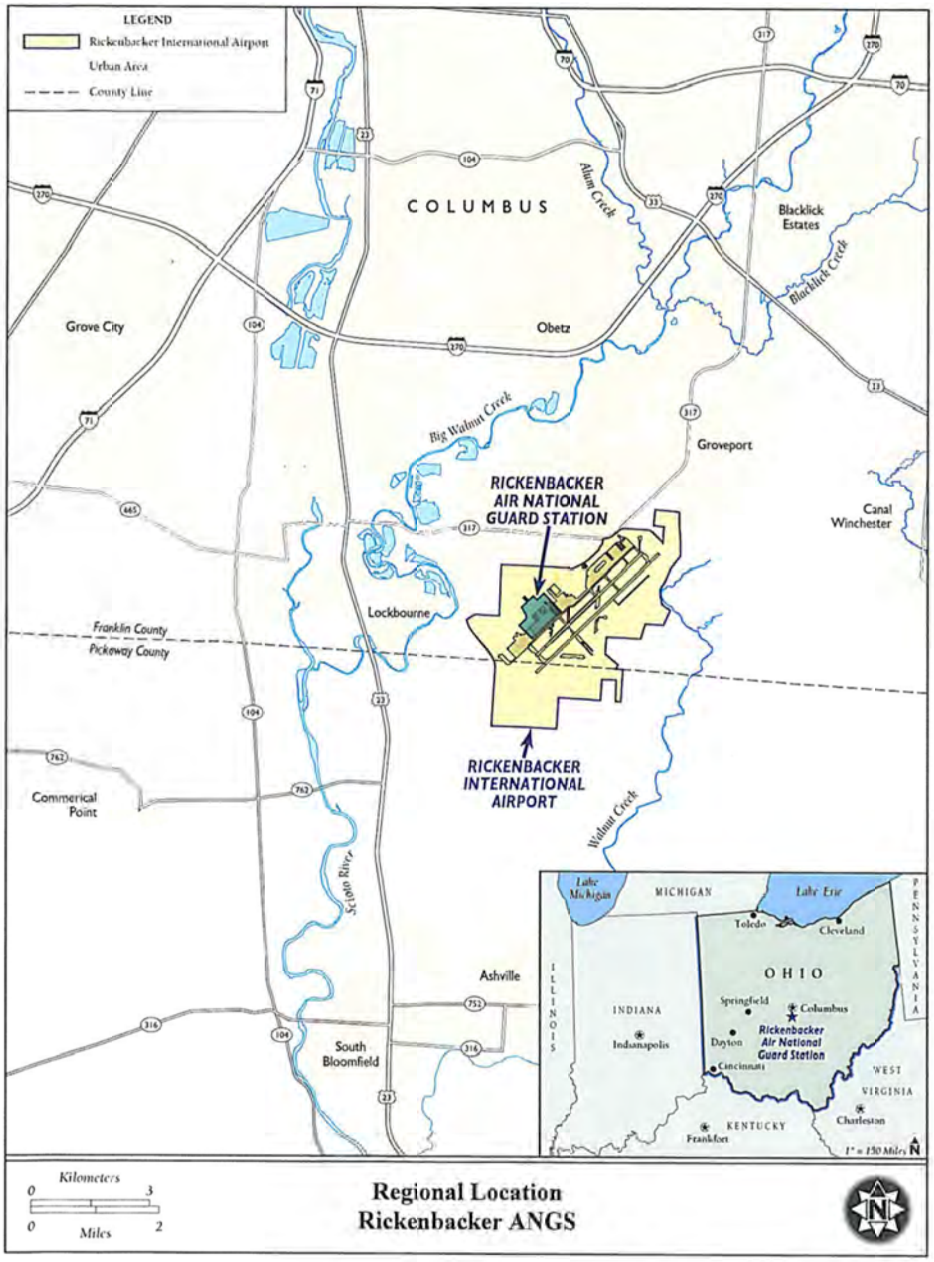
Forbes and Rickenbacker Sample Tribal Letter



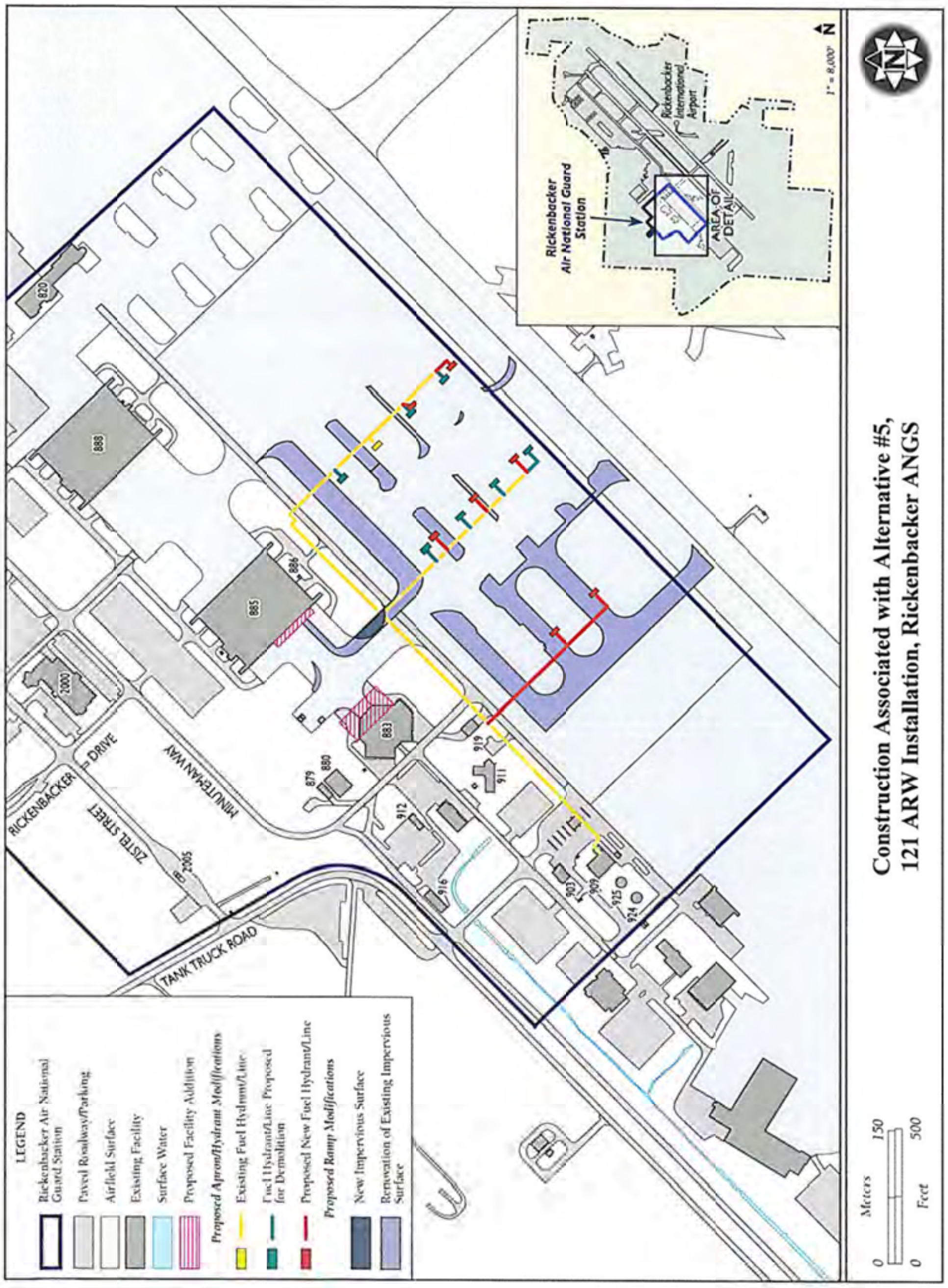
Forbes and Rickenbacker Sample Tribal Letter



Forbes and Rickenbacker Sample Tribal Letter



Forbes and Rickenbacker Sample Tribal Letter



The sample tribal letter following was distributed to the list below:

Guy Munroe, Chairman, Kaw Nation, Drawer 50, Kaw City, OK 74641
Andrea Hunter, THPO, Osage Nation of Oklahoma, 627 Grandview, Pawhuska, OK 74056
John Redeagle, Principal Chief, Osage Nation of Oklahoma, PO Box 779, 627 Grandview, Pawhuska, OK 74056
George Blanchard, Absentee Shawnee Tribe of Oklahoma, 2025 S Gordon Cooper Dr, Shawnee, OK 74801
Henryetta Ellis, THPO, Absentee Shawnee Tribe of Oklahoma, 2025 S Gordon Cooper Dr, Shawnee, OK 74801
Leslie Standing, President, Wichita and Affiliated Tribes, PO Box 729, Anadarko, OK 73005

Forbes Sample Tribal Letter

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

24 September 2013

NGB/A7A

Guy Munroe
Chairman
Kaw Nation
Drawer 50
Kaw City, OK 74641

Dear Chairman Munroe

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified locations for the beddown of a formal training unit (FTU) and the first Main Operating Base (MOB 1*), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second Main Operating Base (MOB 2), which will be led by an Air National Guard (ANG) unit.

Two separate Environmental Impact Statements (EISs) are being prepared for the MOB 1/FTU, and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including Forbes ANGS in Kansas (Attachment 1). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A at Forbes ANGS as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change to the mix of aircraft using the associated airspace; changes to staffing and manpower at the selected location; changes to the number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this action.

* The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

Forbes Sample Tribal Letter

Page 2

At Forbes ANGS, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher, and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. Therefore, the National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this action to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Construction includes options for some of the facilities, but in general there would be an addition to Hangar 662; either interior modifications or an addition to Hangar 665; internal renovations to Building 679; and an addtion and demolition of fuel hydrants and associated fuel lines on the aircraft parking apron.

Kaw Nation has been identified as potentially having historic ties to this location. In accordance with Section 106 of the National Historic Preservation Act (NHPA) (36 Code of Federal Regulations Parts 800.2, 800.3, and 800.4), and in deference to Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, the 190th Air Refueling Wing (190 ARW) would like to initiate government-to-government consultation regarding the aircraft beddown. In May 2013, as part of the NEPA process, a public participation letter was sent informing various Tribes of the Proposed Action and the locations and times of public information and input meetings. This letter reflects an initiation of the NHPA consultation process under Section 106 for the same action.

The 190 ARW would like to discuss the proposed undertaking in detail with you, and to understand and consider any comments, concerns, and suggestions you may have. In particular, the NGB requests your input as to the status of any traditional resources or historic properties that may be located in or near the proposed APE for this undertaking at the Forbes ANGS (Attachment 2).

The entire Forbes ANGS has been surveyed for archaeological resources and none have been identified (KS ANG 2008). However, within the proposed APE or the vicinity of this APE, there may be other cultural resources, including traditional resources, known to the Kaw Nation that would need to be considered in relation to the proposed undertaking.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 3), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

Forbes Sample Tribal Letter

Page 3

Please let us know when you would like to meet to discuss the proposed aircraft beddown and your expectations on how we will accomplish the consultations. You may contact 2d Lt Jarrod Brunkow, Environmental Manager for Forbes ANGS, at (785) 861-4402 or jarrod.brunkow@ang.af.mil. You also may request an individual or group meeting with your Tribe.

We look forward to working with the Kaw Nation in the NHPA Section 106 and government-to-government consultation processes.

Sincerely

WILLIAM P. ALBRO, P.E., GS-15
Associate Director, Installations and Mission Support

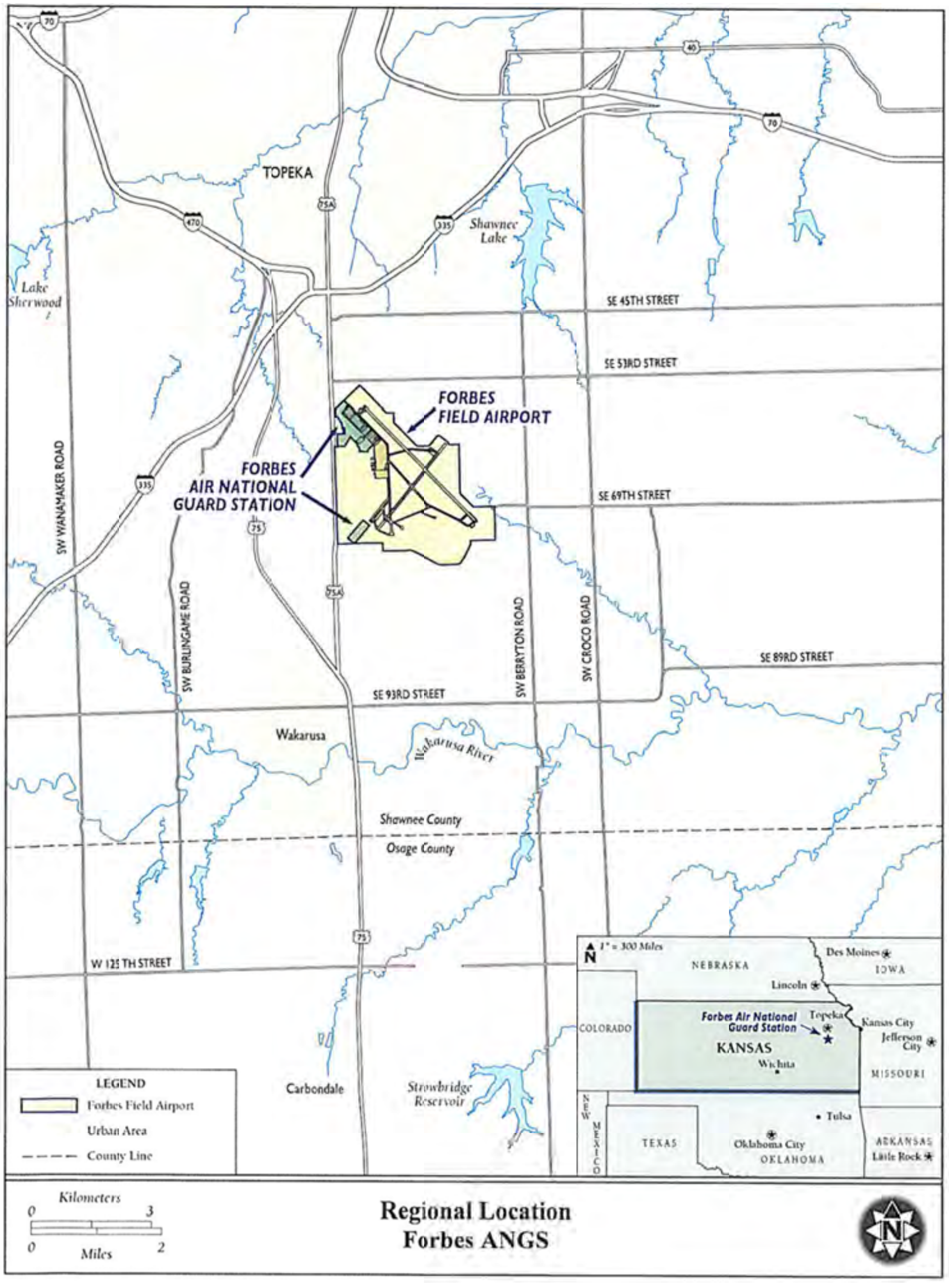
cc:
2d Lt Jarrod Brunkow, KS ANG
Colonel Ron Krueger, Wing Commander

Attachments:
1. Vicinity Map of Forbes ANGS
2. Map of Area of Potential Effect
3. Draft Description of the Proposed Action and Alternatives

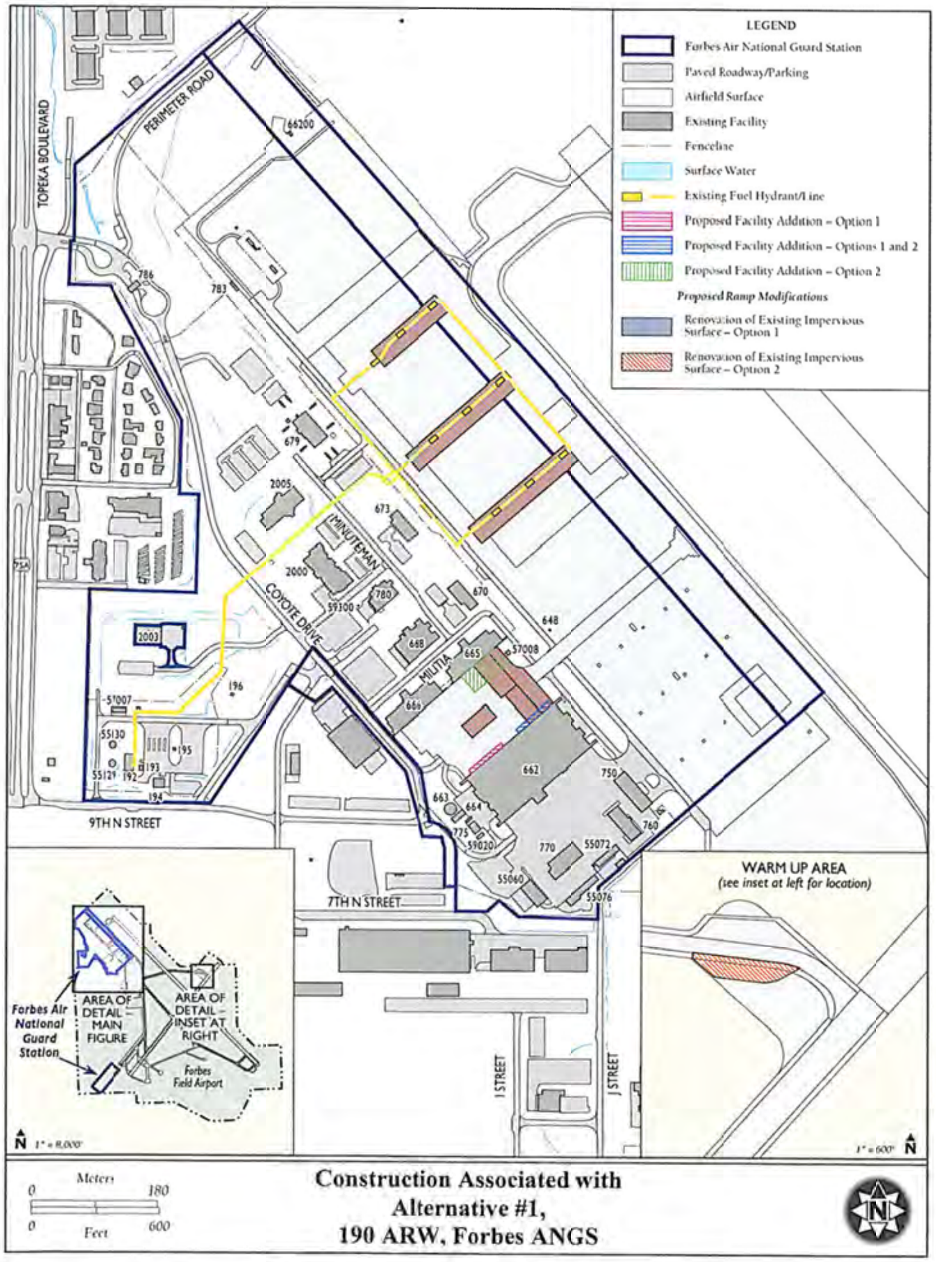
Reference:

Kansas Air National Guard (KS ANG)
2008 *Cultural Resources Survey and Evaluation Report for Kansas Air National Guard Properties at Forbes Field, Topeka, Kansas.* Prepared for Kansas Air National Guard and Air National Guard, National Guard Bureau. June 2008.

Forbes Sample Tribal Letter



Forbes Sample Tribal Letter



The sample tribal letter following was distributed to the list below:

Brice Obermeyer, THPO, Delaware Tribe of Indians, Department of Sociology and Anthropology, Emporia State University, Roosevelt Hall, Rm 212, 1200 Commercial St, Emporia, KS 66801
Paula Pechonick, Chief, Delaware Tribe of Indians, 170 NE Barbara St, Bartlesville, OK 74006
Chester Brooks, Trust Board Chairman, Delaware Tribe of Indians, 170 NE Barbara St, Bartlesville, OK 74006

JB MDL Sample Tribal Letter

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

24 September 2013

NGB/A7A

Brice Obermeyer
THPO
Delaware Tribe of Indians
Department of Sociology and Anthropology, Emporia State University
Roosevelt Hall, Rm. 212
1200 Commercial St.
Emporia, KS 66801

Dear Dr. Obermeyer

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified alternatives for the beddown of a Formal Training Unit (FTU) and the first Main Operating Base (MOB 1*), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second Main Operating Base (MOB 2), which will be led by an Air National Guard (ANG) unit.

Two separate Environmental Impact Statements (EISs) are being prepared for the MOB 1/FTU, and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including JB MDL in New Jersey (Attachment 1). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A at JB MDL as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change to the mix of aircraft using the associated airspace; changes to

* The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

JB MDL Sample Tribal Letter

staffing and manpower at the selected location; changes to the number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this action.

At JB MDL, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher, and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. Therefore, the National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this action to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Specifically, these activities would include an addition to Hangar 3333, an addition to Hangar 3336, interior renovations to Hangar 3332, construction of a new 6,700 square foot simulator building west of Building 3390, modifications/additions to the existing aircraft ramp and taxiway, and the addition of eight new fuel hydrants and associated fuel lines on the aircraft parking apron

The Delaware Tribe of Indians has been identified as potentially having historic ties to this location. In accordance with Section 106 of the National Historic Preservation Act (NHPA) (36 Code of Federal Regulations Parts 800.2, 800.3, and 800.4), and Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments,* the 108th Wing (108 WG) would like to initiate government-to-government consultation regarding the aircraft beddown. In May 2013, as part of the NEPA process, a public participation letter was sent informing various Tribes of the Proposed Action and the locations and times of public information and input meetings. This letter reflects an initiation of the NHPA consultation process under Section 106 for the same action.

The 108 WG would like to discuss the proposal in detail with you, and to understand and consider any comments, concerns, and suggestions you may have. In particular, the NGB requests your input as to the status of any traditional resources or historic properties that may be located in or near the proposed APE for this undertaking at the JB MDL ANGS (see attached map).

JB MDL has been surveyed for archaeological resources and none have been identified within the proposed APE (Headquarters Air Mobility Command [HQ AMC] 1995, AMC 1996, Holmes 1996, Holmes *et ai.* 1997, McGuire AFB 2003, Holmes and Goar 1998). Three historic archaeological sites were recommended eligible for inclusion in the National Register of Historic Places (NRHP). These sites are all well outside the proposed APE for this undertaking. However, within the proposed APE or the vicinity of this APE, there may be other cultural resources, including traditional resources, known to the Delaware Tribe of Indians that would need to be considered in relation to the proposed undertaking.

JB MDL Sample Tribal Letter

Page 3

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 3), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

Please let us know when you would like to meet to discuss the proposed aircraft beddown and your expectations on how we will accomplish the consultations. You may contact Lt Robert Mendez, Environmental Manager for JB MDL, at (609) 754-3718 or robert.mendez@ang.af.mil. You also may request an individual or group meeting with your Tribe.

We look forward to working with the Delaware Tribe of Indians in the NHPA Section 106 and government-to-government consultation processes.

Sincerely

WILLIAM P. ALBRO, P.E., GS-15
Associate Director, Installations and Mission Support

cc:
Colonel Kevin Keehn, 108th Wing Commander, JB MDL
Lt Robert Mendez, JB MDL

Attachments:
1. Vicinity Map of JB MDL
2. Map of Area of Potential Effect
3. Draft Description of the Proposed Action and Alternatives

References:

Air Mobility Command (AMC)
1996 *Inventory of Cold War Properties.* December 1996.

Headquarters Air Mobility Command (HQ AMC)
1995 *An Archaeological and Historical Resources Inventory of McGuire Air Force Base, New Jersey.* Prepared by Moeller, K.L., D.A. Walitschek, M. Greby, and J.F. Hoffecker of the Argonne National Laboratory for McGuire AFB.

JB MDL Sample Tribal Letter

Holmes, Richard D.
1996 *Phase II Testing of Four Historic Sites McGuire Air Force Base Burlington County, New Jersey*. April 1996. Prepared by Mariah Associates, Inc., Albuquerque, New Mexico and Lyndhurst, New Jersey. Prepared for US Air Force/Air Mobility Command, Scott Air Force Base, Illinois.

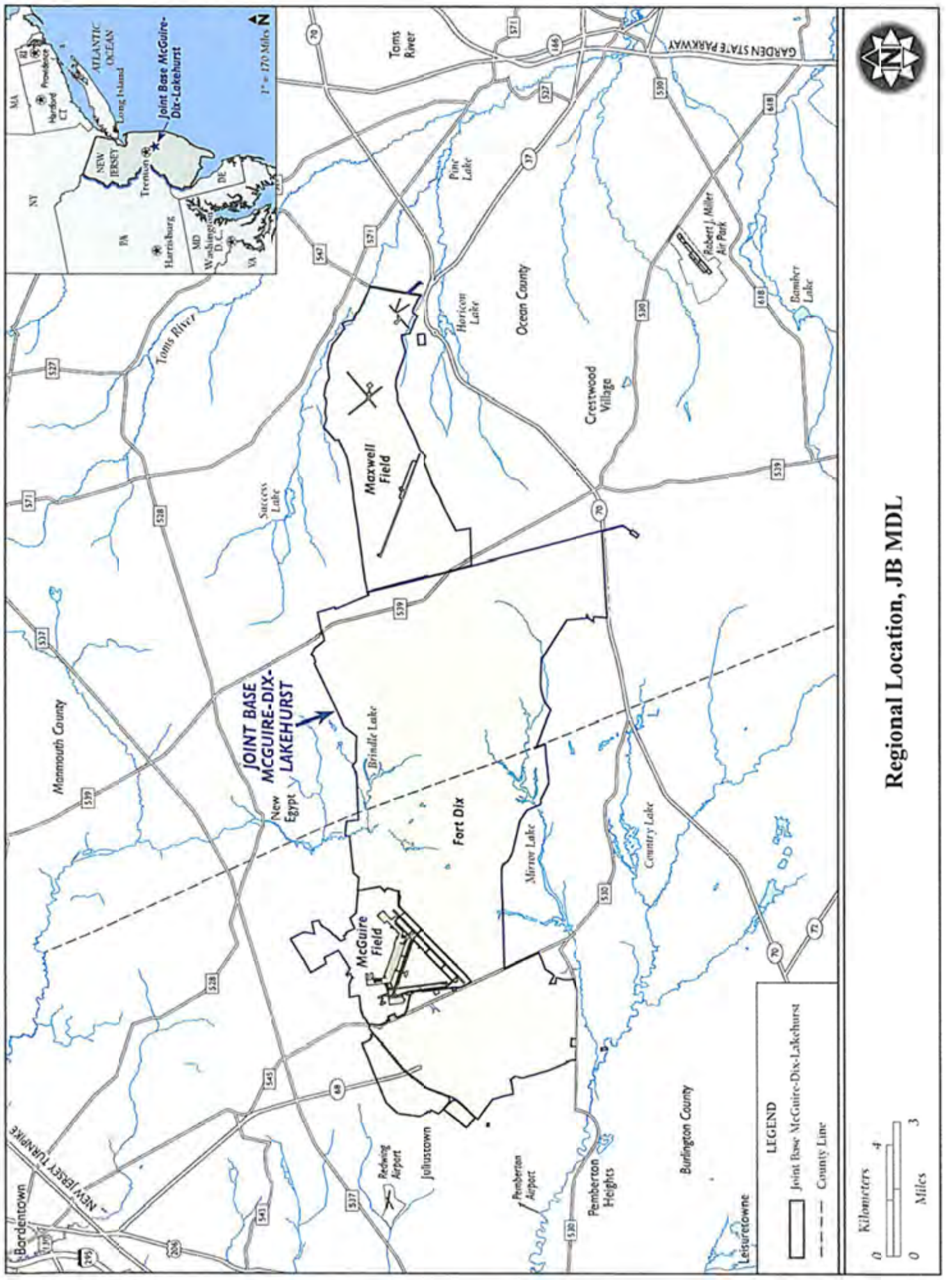
Holmes, Richard D., Toni R. Goar, and Katherine J. Roxlau
1997 *Phase I Archaeological Survey of Areas 4100 and 4200 McGuire Air Force Base, New Hanover Township, Burlington County, New Jersey*. November 1997. Prepared by TRC Mariah Associates, Inc. Prepared for US Army Corps of Engineers New York District and US Air Force/Air Mobility Command Scott Air Force Base, Illinois.

Holmes, Richard D. and Toni R. Goar
1998 *Phase II Site Testing of Four Historic Site McGuire Air Force Base Burlington County, New Jersey*. January 1998. Prepared by TRC Mariah Associates, Inc. Prepared for US Air Force/Air Mobility Command, Scott Air Force Base.

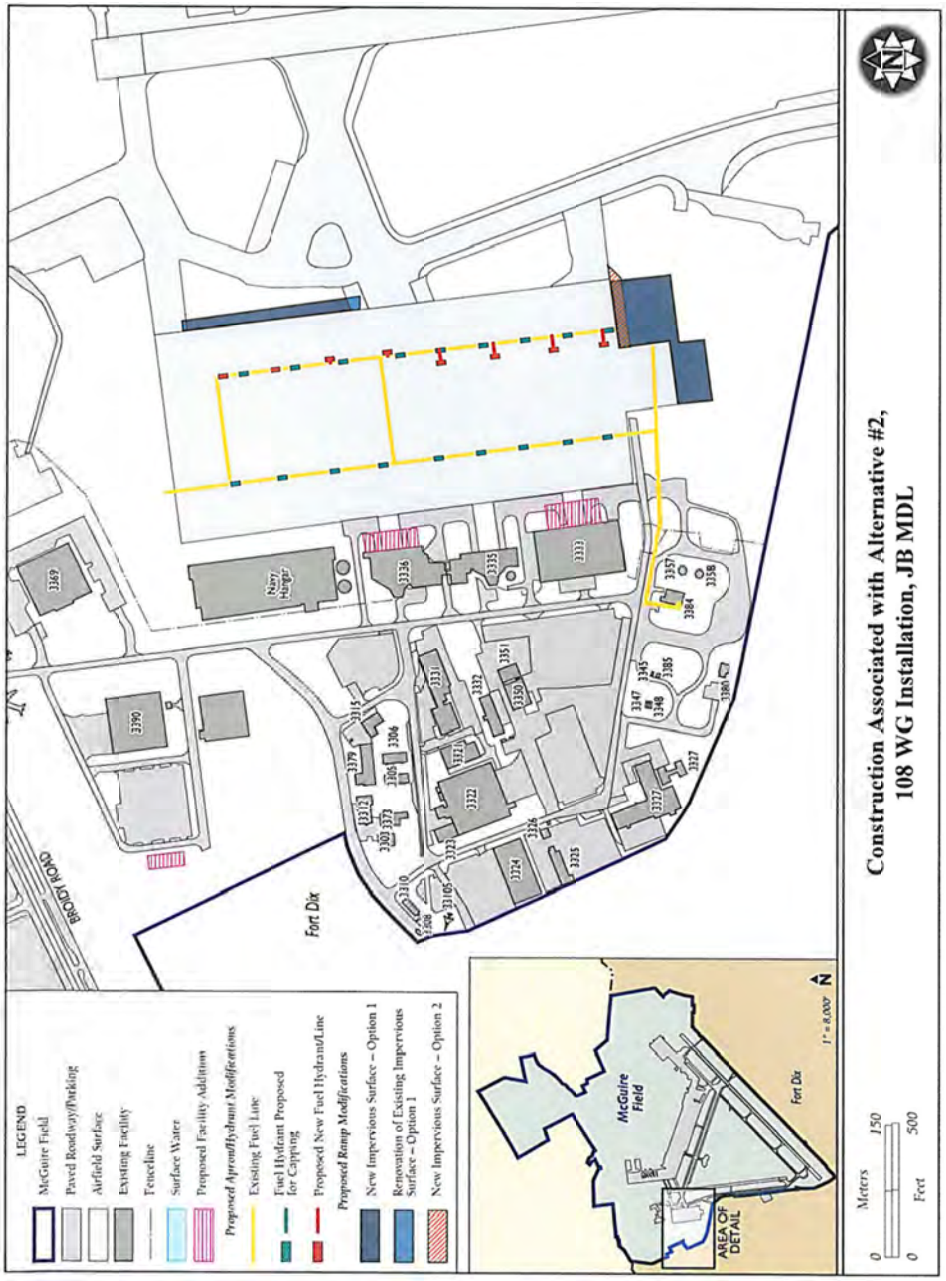
Joint Base McGuire-Dix-Lakehurst (JB MDL)
2013 *Draft Integrated Cultural Resources Management Plan*. 87 CES/CEAN, JB MDL, New Jersey. January 2013.

McGuire Air Force Base (AFB)
2003 *Final Integrated Cultural Resources Management Plan*. Prepared 2003. Updated July 2005.

JB MDL Sample Tribal Letter



JB MDL Sample Tribal Letter



Stockbridge-Munsee Tribal Historic Preservation Office

Sherry White - Tribal Historic Preservation Officer
W13447 Camp 14 Road
P.O. Box 70
Bowler, WI 54416

Date 5-13-11
Project Number Joint Base McGuire Dix Lakehurst
TCNS Number
Company Name Department of Airforce

We have received you letter for the above listed project. Before we can process the request we need more information. The additional items needed are checked below.

Additional Information Required:

_____Site visit by Tribal Historic Preservation Officer
_____Archeological survey, Phase 1
_____Literature/record search including colored maps
_____Pictures of the site
_____Any reports the State Historic Preservation Office may have
_____Has the site been previously disturbed
_____Review fee must be included with letter

If site has been previously disturbed please explain what the use was and when it was disturbed

Other comments or information needed_______________________________

After reviewing your letter we find that:

_____"No Properties" the Tribe concurs with a Federal agency's finding that there are no National Register eligible or listed properties within the Federal undertaking's area of potential effect or APE 36CFR 800.4 (d) (1)

_____"No Effect" historic or prehistoric properties are present but the Federal undertaking will have no effect on the National Register eligible or listed properties as defined in Sec. 800.16(i)

_____"No Adverse Effect" refers to written opinions provided to a Federal agency as to whether or not the Tribe agrees with (or believes that there should be) a Federal agency finding that its Federal undertaking would have "No Adverse Effect" 36 CFR 800.5(b)

(715) 793-3970 *Email: sherry.white@mohican-nsn.gov*

"Adverse Effect" refers to written opinions provided to a Federal Agency that undertaking would cause Adverse Effects to the area of potential effect on National Register or eligible properties according to the criteria set forth in 36 CFR 800. 5(a) (1), (2) (i)- (vii)

✓ Project not within a county the Mohican Tribe has interest in

Should this project inadvertently uncover a Native Amercian site, we ask that you halt all construction and notify the Stockbridge-Munsee Tribe immediately

Please do not resubmit project for changes that are not ground disturbance.

Sincerely,

Sherry White

Sherry White
Tribal Historic Preservation Officer

The sample tribal letter following was distributed to the list below:

Kirk Francis, Tribal Chief, Penobscot Indian Nation, 12 Wabanaki Way, Indian Island, ME 04668
Bonnie Newsom, THPO, Penobscot Indian Nation, 12 Wabanaki Way, Indian Island, ME 04468

Pease Sample Tribal Letter

NATIONAL GUARD BUREAU

3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

24 September 2013

NGB/A7A

Kirk Francis
Tribal Chief
Penobscot Indian Nation
12 Wabanaki Way
Indian Island, ME 04668

Dear Chief Francis

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified alternatives for the beddown of a Formal Training Unit (FTU) and the first Main Operating Base (MOB 1*), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second Main Operating Base (MOB 2), which will be led by an Air National Guard (ANG) unit.

Two separate Environmental Impact Statements (EISs) are being prepared for the MOB 1/FTU, and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including Pease ANGS in New Hampshire (Attachment 1). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A at Pease ANGS as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change to the mix of aircraft using the associated airspace; changes to staffing and manpower at the selected location; changes to the number of airfield

* The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

Pease Sample Tribal Letter

Page 2

operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this action.

At Pease ANGS, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher, and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. Therefore, the National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this action to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Construction activities would include: renovations and additions to Hangars 251, 252, 253, and 254; construction and upgrade of the aircraft taxiway; repaving of the quad apron; and demolition of existing fuel hydrants and associated fuel lines and installation of new hydrants and lines on the aircraft parking apron

The Penobscot Indian Nation has been identified as potentially having historic ties to this location. In accordance with Section 106 of the National Historic Preservation Act (NHPA) (36 Code of Federal Regulations Parts 800.2, 800.3, and 800.4), and in deference to Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments,* the 157th Air Refueling Wing (157 ARW) would like to initiate government-to-government consultation regarding the aircraft beddown. In May 2013, as part of the NEPA process, a public participation letter was sent informing various Tribes of the proposed action and the locations and times of public information and input meetings. This letter reflects an initiation of the NHPA consultation process under Section 106 for the same action.

The 157 ARW would like to discuss the proposed undertaking in detail with you, and to understand and consider any comments, concerns, and suggestions you may have. In particular, the NGB requests your input as to the status of any traditional resources or historic properties that may be located in or near the proposed APE for this undertaking at the Pease ANGS (see attached map).

Pease ANGS has been surveyed for archaeological resources and none have been identified (157th Air Refueling Wing [157 ARW] 2009). However, within the proposed APE or the vicinity of this APE, there may be other cultural resources, including traditional resources, known to the Penobscot Indian Nation that would need to be considered in relation to the proposed undertaking.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 3), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

Pease Sample Tribal Letter

Page 3

Please let us know when you would like to meet to discuss the aircraft beddown proposal and your expectations on how we will accomplish the consultations. You may contact Andy Smith, Environmental Manager for Pease ANGS, at (603) 430-2336 or andrew.smith.7@ang.af.mil. You also may request an individual or group meeting with your Tribe.

We look forward to working with the Penobscot Indian Nation in the NHPA Section 106, and government-to-government consultation processes.

Sincerely

WILLIAM P. ALBRO, P.E., GS-15
Associate Director, Installations and Mission Support

cc:
Colonel Paul Hutchinson, 157th Wing Commander, Pease ANGS
Mr. Andy Smith, Pease ANGS

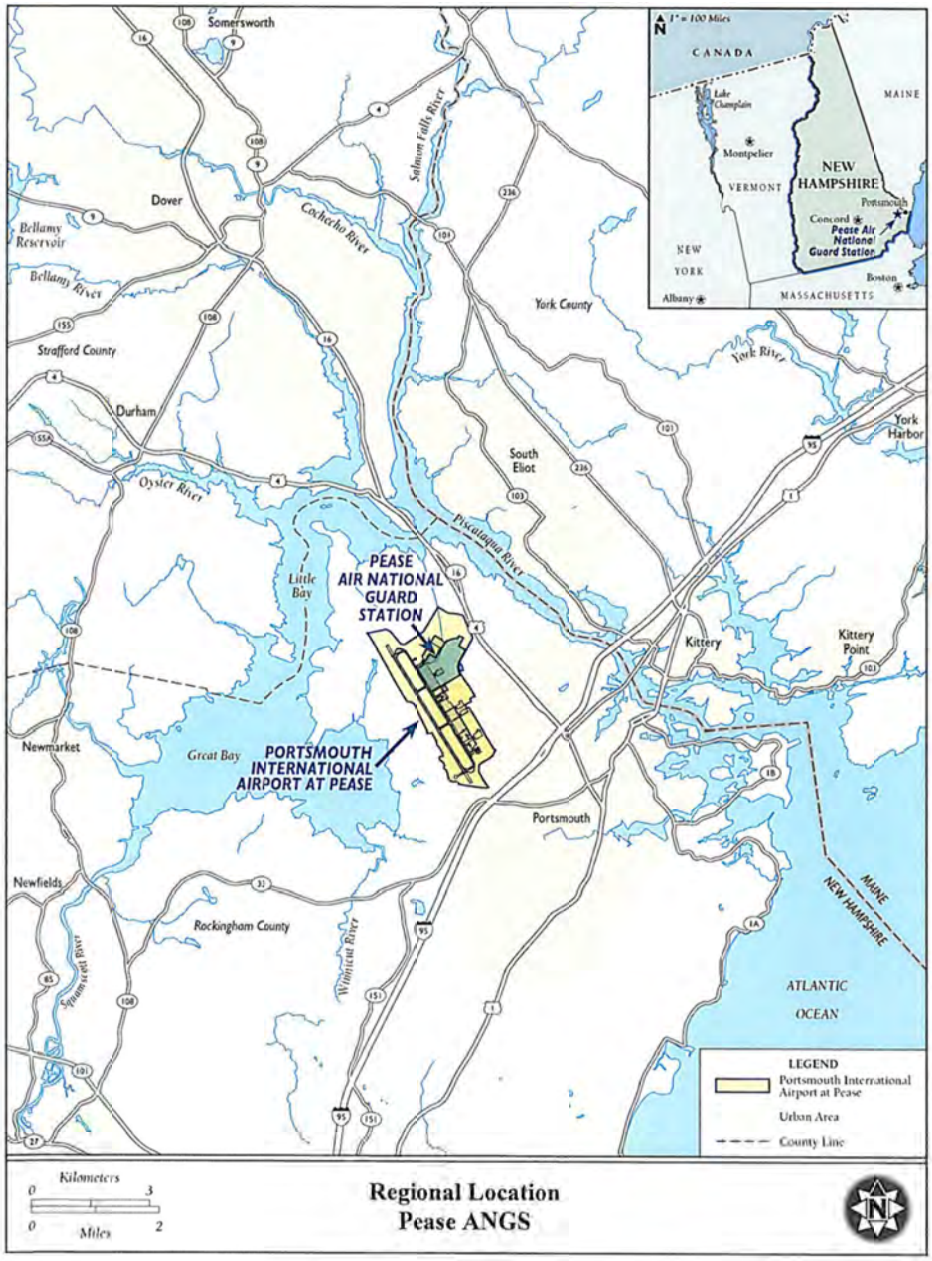
Attachments:

1. Vicinity Map of Pease ANGS
2. Map of Area of Potential Effect
3. Draft Description of the Proposed Action and Alternatives

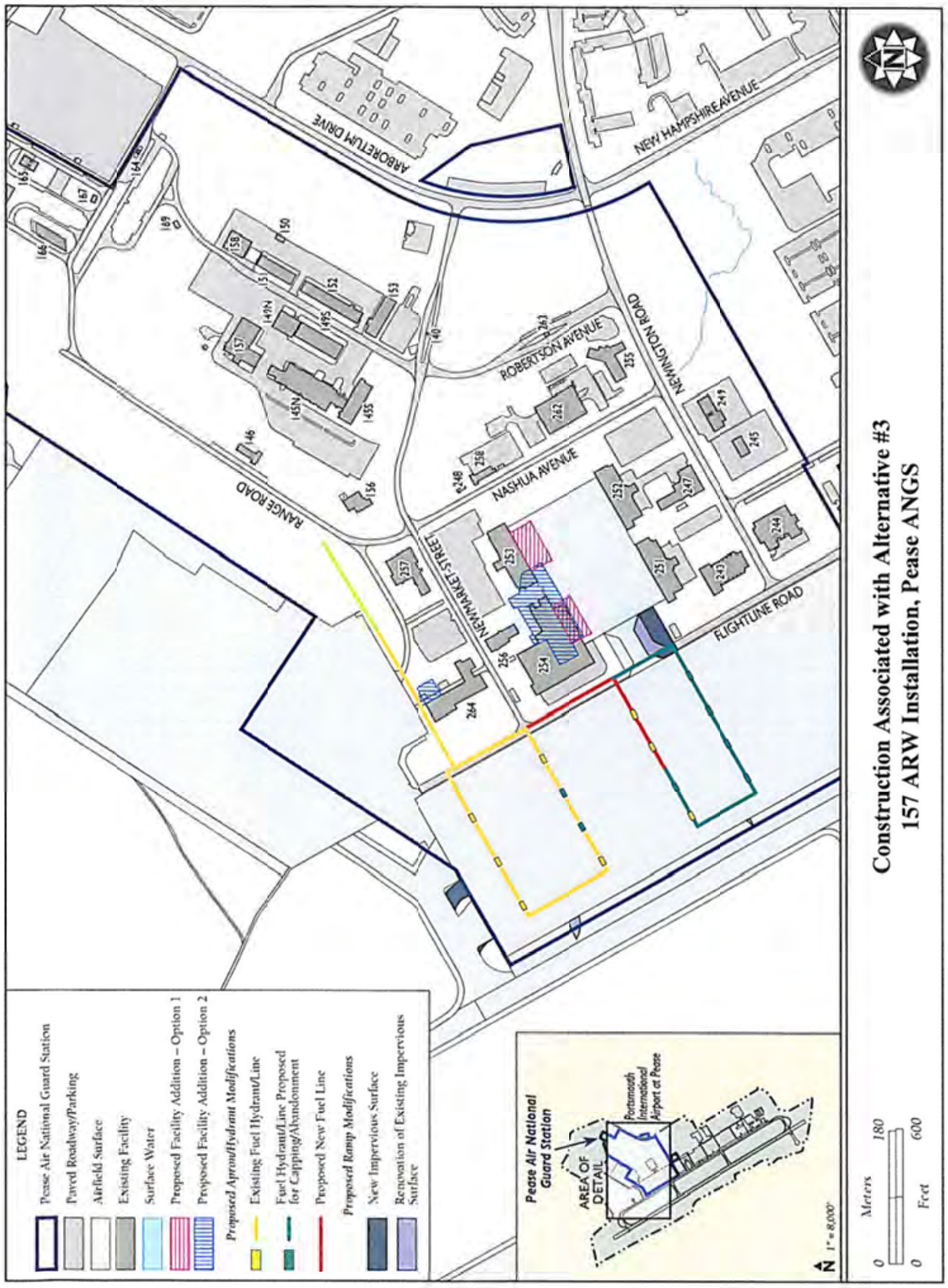
Reference:

157th Air Refueling Wing (157 ARW)
2009 *Cultural Resources Survey of the 157 Air Refueling Wing, New Hampshire Air National Guard, Pease International Tradeport, Town of Newington, Rockingham County, New Hampshire.* Prepared for New Hampshire Air National Guard and Air National Guard Readiness Center, National Guard Bureau. April 2009.

Pease Sample Tribal Letter



Pease Sample Tribal Letter



The sample tribal letter following was distributed to the list below:

Melinda Maybee, Nation Representative, Cayuga Nation of New York, PO Box 803, Seneca Falls, NY 13148
Irving Powless, Chief, Onondaga Nation of New York, RRT#1, PO Box 319-B, Nedrow, NY 13120
Leo Henry, Chief, Tuscarora Nation of New York, 2006 Mt Hope Rd, Lewiston, NY 14092
Robert Odawi Porter, President, Seneca Nation of Indians, 12837 Rte. 438, Irving, NY 14081
Lana Watt, THPO, Seneca Nation of Indians, 90 Ohiyo Way, Salamanca, NY 14779
Roger Hill, Chief, Tonawanda Band of Seneca, 7027 Meadville Rd, Basom, NY 14013

Pittsburgh Sample Tribal Letter

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

24 September 2013

NGB/A7A

Melinda Maybee
Nation Representative
Cayuga Nation of New York
PO Box 803
Seneca Falls, NY 13148

Dear Ms. Maybee

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified locations for the beddown of a Formal Training Unit (FTU) and the first Main Operating Base (MOB 1*), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second Main Operating Base (MOB 2), which will be led by an Air National Guard (ANG) unit.

Two separate Environmental Impact Statements (EISs) are being prepared for the MOB 1/FTU, and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including Pittsburgh ANGS in Pennsylvania (Attachment 1). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A at Pittsburgh ANGS as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change to the mix of aircraft using the associated airspace; changes to staffing and manpower at the selected location; changes to the number of

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* The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

Pittsburgh Sample Tribal Letter

airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this action.

At Pittsburgh ANGS, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher, and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. Therefore, the National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this action to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Construction activities would include: an addition to Hangar 302; an addition to hangar 320; interior renovations to hangar 301; modifications to the aircraft ramp and taxiway; and the addition of eight new fuel hydrants and associated fuel lines on the aircraft parking apron; and possible demolition or capping of existing fuel hydrants and lines on the parking apron.

The Cayuga Nation of New York has been identified as potentially having historic ties to this location. In accordance with Section 106 of the National Historic Preservation Act (NHPA) (36 Code of Federal Regulations Parts 800.2, 800.3, and 800.4), and in deference to Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, the 171st Air Refueling Wing (171 ARW) would like to initiate government-to-government consultation regarding the aircraft beddown. In May 2013, as part of the NEPA process, a public participation letter was sent informing various Tribes of the Proposed Action and the locations and times of public information and input meetings. This letter reflects an initiation of the NHPA consultation process under Section 106 for the same action.

The 171 ARW would like to discuss the proposed undertaking in detail with you, and to understand and consider any comments, concerns, and suggestions you may have. In particular, the NGB requests your input as to the status of any traditional resources or historic properties that may be located in or near the proposed APE for this undertaking at the Pittsburgh ANGS (see attached map).

The entire Pittsburgh ANGS has been surveyed for archaeological resources and none have been identified (Cardno TEC, Inc. 2011). Therefore, it is anticipated that no archaeological sites would be affected by the proposed undertaking. However, within the proposed APE or the vicinity of this APE, there may be other cultural resources, including traditional resources, known to the Cayuga Nation of New York that would need to be considered in relation to the proposed undertaking.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 3), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of

Pittsburgh Sample Tribal Letter

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the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

Please let us know when you would like to meet to discuss the proposed aircraft beddown and your expectations on how we will accomplish the consultations. You may contact Lt Col John Tower, Environmental Manager for Pittsburgh ANGS, at (412) 776-7640 or john.tower@ang.af.mil. You also may request an individual or group meeting with your Tribe.

We look forward to working with the Cayuga Nation of New York in the NHPA Section 106 and government-to-government consultation processes.

Sincerely

WILLIAM P. ALBRO, P.E., GS-15
Associate Director, Installations and Mission Support

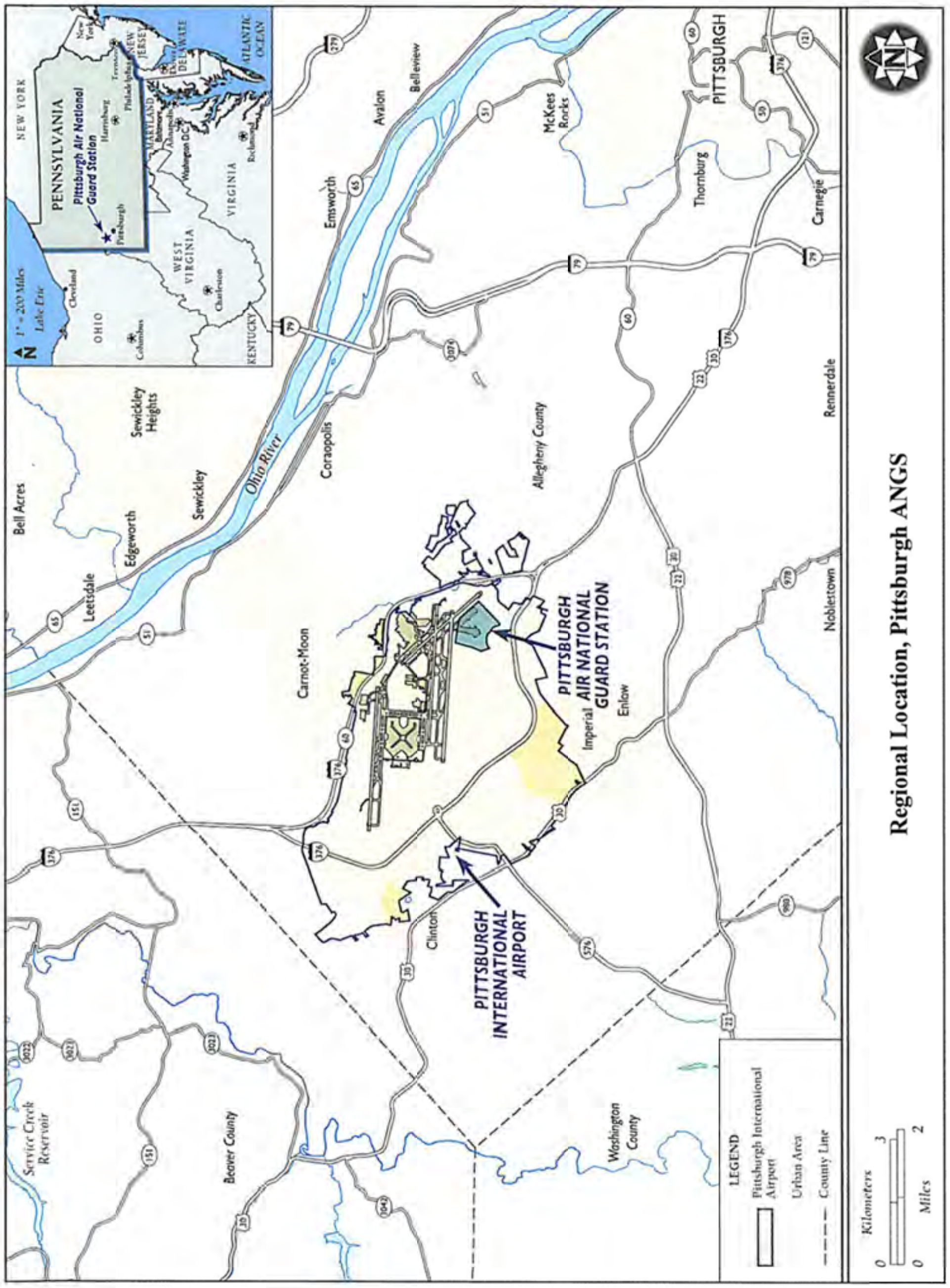
cc:
Colonel Steven Painter, 171st Wing Commander, Pittsburgh ANGS
Lt Col John Tower, Pittsburgh ANGS

Attachments:
1. Vicinity Map of Pittsburgh ANGS
2. Map of Area of Potential Effect
3. Draft Description of the Proposed Action and Alternatives

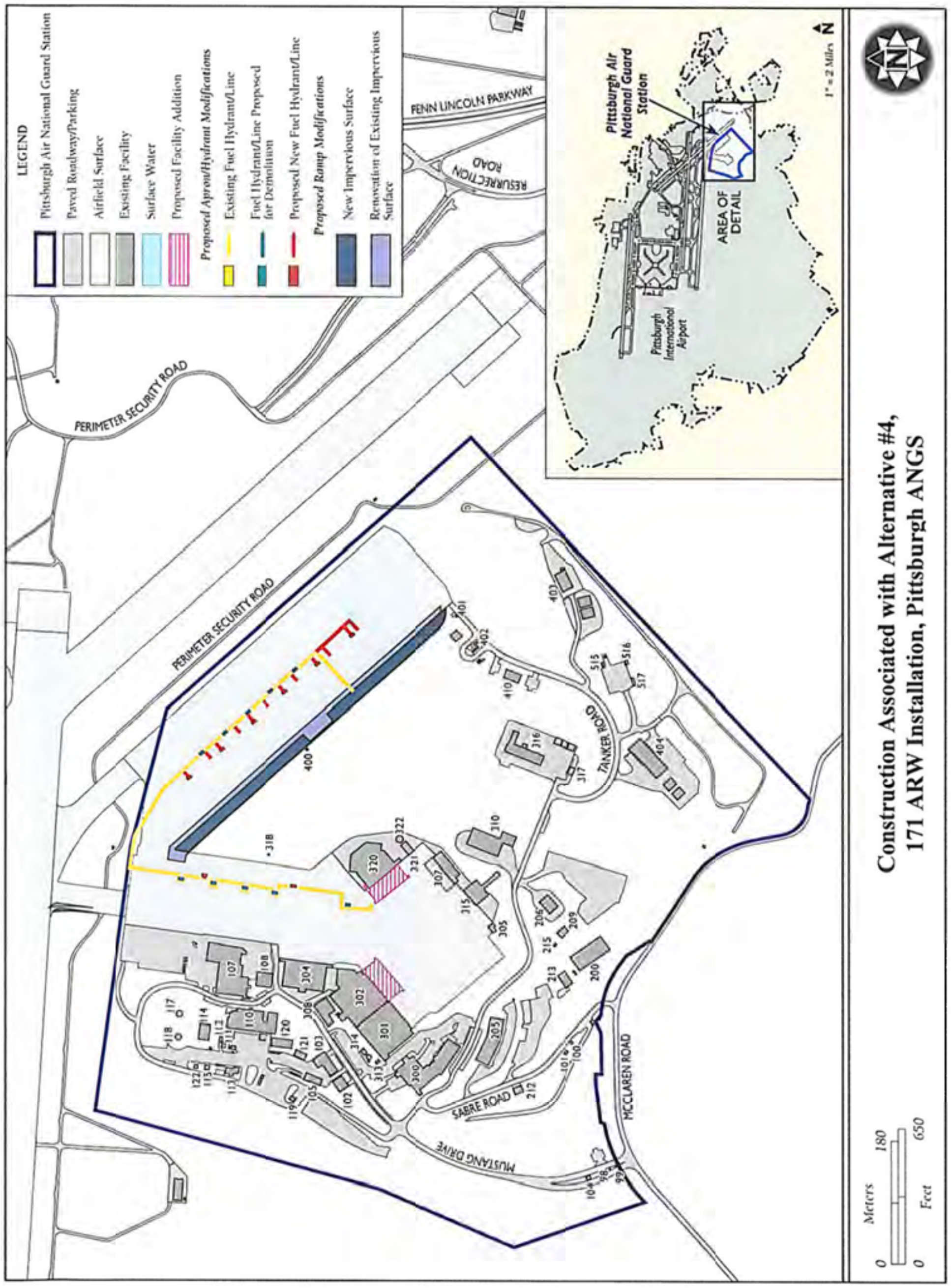
Reference:

Cardno TEC, Inc.
2011 *Cultural Resources Survey at the 171 Air Refueling Wing, Pittsburgh, Pennsylvania.* Prepared by TEC

Pittsburgh Sample Tribal Letter



Pittsburgh Sample Tribal Letter



The sample tribal letter following was distributed to the list below:

Ron Sparkman, Chief, Shawnee Tribe, PO Box 189, Miami, OK 74355
Jodi Hayes, Tribe Administrator, Shawnee Tribe, PO Box 189, Miami, OK 74355
Harold Frank, Chairman, Forest County Potawatomi Community, PO Box 340, Crandon, WI 54520
Kenneth Meshigaud, Chairperson, Hannahville Indian Community, N14911 Hannahville B1 Rd, Wilson, MI 49896-9728
George Strack, THPO, Miami Tribe of Oklahoma, PO Box 1326, Miami, OK 74355-1326
Thomas Gamble, Chairperson, Miami Tribe of Oklahoma, PO Box 1326, Miami, OK 74355-1326
Ethel áá Cooká, Chief, Ottawa Tribe of Oklahoma, PO Box 110, Miami, OK 74355
John Froman, Chief, Peoria Tribe of Indians of Oklahoma, PO Box 1527, Miami, OK 74355
Matthew Wesaw, Chairman, Pokagon Band of Potawatomi Indians, PO Box 180, Dowagiac, MI 49047
Mike Zimmerman, THPO, Pokagon Band of Potawatomi Indians, PO Box 180, Dowagiac, MI 49047
Kade Ferris, THPO, Turtle Mountain Band of Chippewa Indians of North Dakota, PO Box 900, Belcourt, ND 58316
Merle St. Claire, Chairman, Turtle Mountain Band of Chippewa Indians of North Dakota, PO Box 900, Belcourt, ND 58316
Billy Friend, Chief, Wyandotte Nation, 64700 E Highway 60, Wyandotte, OK 74370
Sherri Clemons, THPO, Wyandotte Nation, 64700 E Highway 60, Wyandotte, OK 74370

Rickenbacker Sample Tribal Letter

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

24 September 2013

NGB/A7A

Ron Sparkman
Chief
Shawnee Tribe
PO Box 189
Miami, OK 74355

Dear Chief Sparkman

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified alternatives for the beddown of a Formal Training Unit (FTU) and the first Main Operating Base (MOB 1*), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second Main Operating Base (MOB 2), which will be led by an Air National Guard (ANG) unit.

Two separate Environmental Impact Statements (EISs) are being prepared for the MOB 1/FTU, and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including Rickenbacker ANGS in Ohio (Attachment 1). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A at Rickenbacker ANGS as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change to the mix of aircraft using the associated airspace; changes to staffing and manpower at the selected location; changes to the

* The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

Rickenbacker Sample Tribal Letter

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number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this action.

At Rickenbacker ANGS, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher, and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. Therefore, the National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this action to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Construction activities would include: additions and renovations to Hangar 885; an addition to Hangar 883; interior renovations to Hangar 888; modifications to the aircraft ramp and taxiway; and addition and demolition of fuel hydrants and associated fuel lines on the aircraft parking apron.

The Shawnee Tribe has been identified as potentially having historic ties to this location. In accordance with Section 106 of the National Historic Preservation Act (NHPA) (36 Code of Federal Regulations Parts 800.2, 800.3, and 800.4), and in deference to Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments,* the 121st Air Refueling Wing (121 ARW) would like to initiate government-to-government consultation regarding the aircraft beddown. In May 2013, as part of the NEPA process, a public participation letter was sent informing various Tribes of the Proposed Action and the locations and times of public information and input meetings. This letter reflects an initiation of the NHPA consultation process under Section 106 for the same action.

The 121 ARW would like to discuss the proposed undertaking in detail with you, and to understand and consider any comments, concerns, and suggestions you may have. In particular, the NGB requests your input as to the status of any traditional resources or historic properties that may be located in or near the proposed APE for this undertaking at the Rickenbacker ANGS (see attached map).

The entire Rickenbacker ANGS has been surveyed for archaeological resources and no significant archaeological resources were encountered (National Guard Bureau [NGB] 2007, NGB 2008, Snyder 2007). However, a few decades previous to the 2008 inventory, during excavations for Building 911 a multi-component site (33FR2844) was uncovered. Site 33FR2844 consisted of a historic burial and a prehistoric lithic scatter. This site was recommended eligible for inclusion on the NRHP when it was discovered in 1985 (121 ARW 2011). This site is the only known significant archaeological resource present within the boundaries of the ANGS and it is well outside the proposed APE for the undertaking. However, within the proposed APE or the vicinity of this APE, there may be other cultural resources, including traditional resources, known to the Shawnee Tribe that would need to be considered in relation to the proposed undertaking.

Rickenbacker Sample Tribal Letter

Page 3

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 3), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

Please let us know when you would like to meet to discuss the proposed aircraft beddown and your expectations on how we will accomplish the consultations. You may contact Roger Jones, Environmental Manager for Rickenbacker ANGS, at (614) 492-4110 or roger.jones@ang.af.mil. You also may request an individual or group meeting with your Tribe.

We look forward to working with the Shawnee Tribe in the NHPA Section 106 and government-to-government consultation processes.

Sincerely

William P. Albro

WILLIAM P. ALBRO, P.E., GS-15
Associate Director, Installations and Mission Support

cc:
Colonel James Jones, 121st Wing Commander, OH ANGS
Mr. Roger Jones, OH ANGS

Attachments:
1. Vicinity Map of Rickenbacker ANGS
2. Map of Area of Potential Effect
3. Draft Description of the Proposed Action and Alternatives

References:

121st Air Refueling Wing (121 ARW)
2011 *Integrated Cultural Resources Management Plan.* May 2011.

National Guard Bureau (NGB)
2007 *Cultural Resources Survey of the 121st Air Refueling Wing, Ohio Air National Guard, Rickenbacker International Airport, Columbus, Franklin County, Ohio.* Prepared for the National Guard Bureau, Air National Guard Readiness Center NGB/A7CVN, Andrews Air Force Base, Maryland. December 2007.

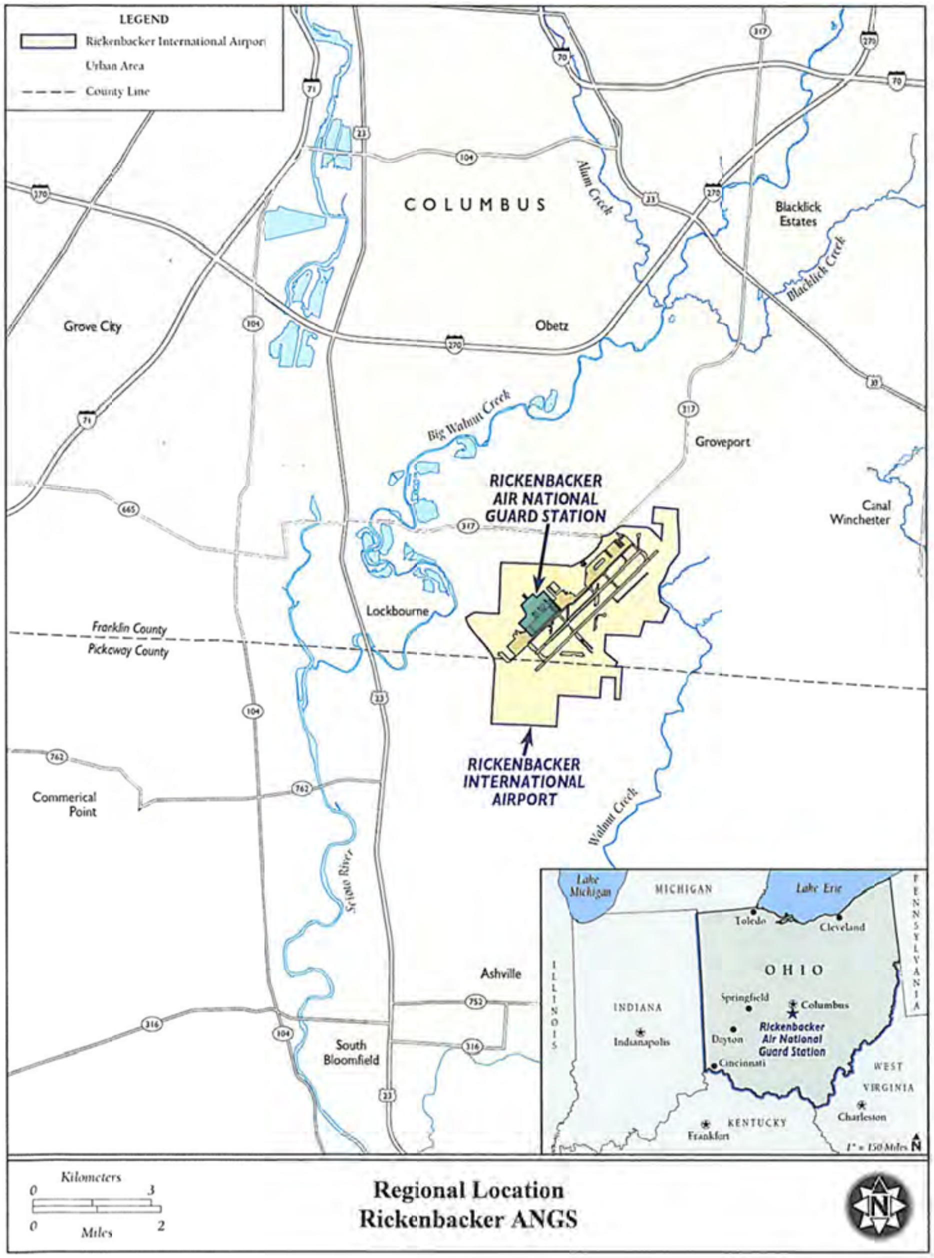
Rickenbacker Sample Tribal Letter

2008 *Cultural Resources Survey of the 121st Air Refueling Wing, Ohio Air National Guard, Rickenbacker International Airport, Columbus, Franklin County, Ohio.* Prepared for the National Guard Bureau, Air National Guard Readiness Center NGB/A7CVN, Andrews Air Force Base, Maryland. January 2008.

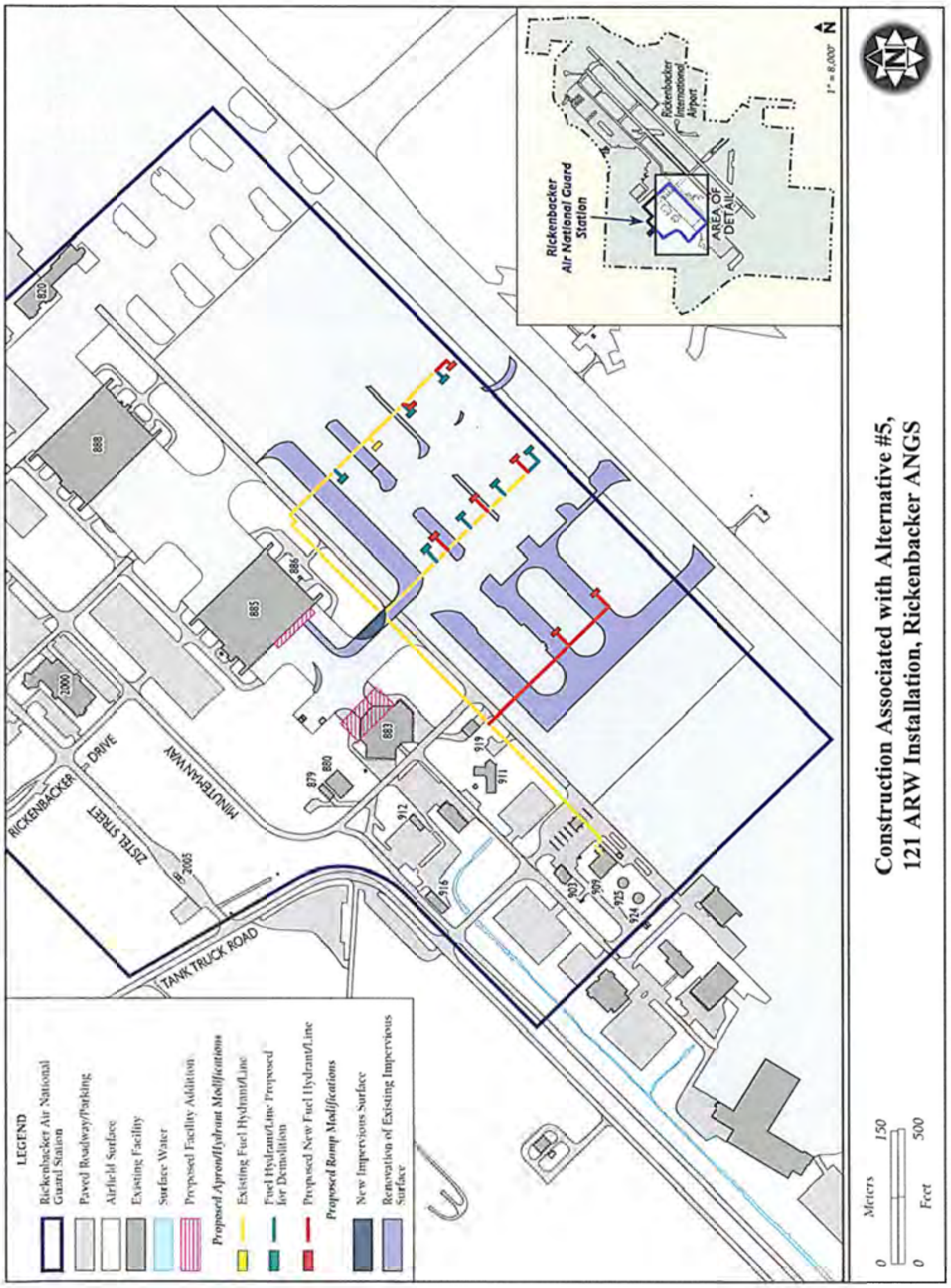
Snyder, David

2007 Letter to Matt Nowakowski, National Guard Bureau from David Snyder, Archaeology Review Manager, Resource Protection and Review, Ohio Historic Preservation Office regarding: *121 ARW Ohio ANG, Rickenbacker IAP, Draft Final Cultural Resources Survey, Hamilton Township, Franklin County, Ohio*. August 23, 2007.

Rickenbacker Sample Tribal Letter



Rickenbacker Sample Tribal Letter



PEORIA TRIBE OF INDIANS OF OKLAHOMA
118 S. Eight Tribes Trail (918) 540-2535 FAX (918) 540-2538
P.O. Box 1527
MIAMI, OKLAHOMA 74355

CHIEF
John P. Froman

SECOND CHIEF
Jason Dollarhide

A7AM
For the file
Albro

October 2, 2013

William P. Albro, P.E., GS-15
Associate Director, Installations and Mission Support
National Guard Bureau
3501 Fetchet Avenue
Joint Base
Andrews, MD 20762-5157

Re: KC-46A Beddown at Possible Location of Rickenbacker ANGS, Ohio (MOB 2)

Thank you for notice of the referenced project. The Peoria Tribe of Indians of Oklahoma is currently unaware of any documentation directly linking Indian Religious Sites to Rickenbacker ANGS. In the event any items falling under the Native American Graves Protection and Repatriation Act (NAGPRA) are discovered during construction, the Peoria Tribe request notification and further consultation.

The Peoria Tribe has no objection to the proposed construction, demolition, and renovation activites. However, if any human skeletal remains and/or any objects falling under NAGPRA are uncovered during construction, the construction should stop immediately, and the appropriate persons, including state and tribal NAGPRA representatives contacted.

Cynthia Stacy

Cynthia Stacy
Special Projects Manager/NAGPRA
Peoria Tribe of Indians of Oklahoma
918-540-2535 Ext. 31
FAX: 918-540-2538
cstacy@peoriatribe.com

TREASURER Aaron Wayne Blalock	SECRETARY Don Giles	FIRST COUNCILMAN Carolyn Ritchey	SECOND COUNCILMAN Craig Harper	THIRD COUNCILMAN Alan Goforth

-----Original Message-----
From: Jay Toth [mailto:jay.toth@sni.org]
Sent: Thursday, October 03, 2013 9:36 AM
To: Tower, John LtCol USAF ANG 171 MDG/SGPB
Subject: MOB 1&2/sec. 106

Seneca HP has no issue regarding the EIS for the MOBs.

JAY toth., MA., MS.

Seneca Nation Tribal archeologist

90 OHI:WAY

Salamanca, NY 14779

(716)945-1790/ ext. 3582

Delaware Tribe Historic Preservation Office
1200 Commercial St.
Roosevelt Hall, RM 212
Emporia State University
Emporia, KS 66801
(620) 341-6699
bobermeyer@delawaretribe.org

October 4, 2013

National Guard Bureau
3501 Fetchett Avenue
Joint Base Andrews, MD 20762-5157

Re: Replacement of KC-135 Fleet with KC-46A fleet

Dear Michael B. Hornum:

Thank you for providing the survey report for the above referenced project. Our review also indicates that there are no religious or culturally significant sites in this project area and we have no objection to the proposed project. We defer comment to your office as well as to the State Historic Preservation Office and/or the State Archaeologist.

However, we ask that if any human remains are accidentally unearthed during the course of the project that you cease development immediately and inform the Delaware Tribe of Indians of the inadvertent discovery.

If you have any questions, feel free to contact this office by phone at (620) 341-6699 or by e-mail at bobermeyer@delawaretribe.org.

Sincerely,

Brice Obermeyer

Brice Obermeyer
Delaware Tribe Historic Preservation Office
1200 Commercial St
Roosevelt Hall, RM 212
Emporia State University
Emporia, KS 66801

-----Original Message-----
From: Chris Sockalexis [mailto:Chris.Sockalexis@penobscotnation.org]
Sent: Tuesday, December 31, 2013 11:24 AM
To: Eck, Christopher R Civ USAF ANG NGB/A7AM
Subject: RE: US Air Force Replacement of KC-135 Air Refueling Fleet with KC-46A Aircraft, Pease Air National Guard Base, New Hampshire

Good Afternoon,

I have reviewed the proposed project by the United States Air Force National Guard Bureau. This includes the replacement of the existing KC-135 air refuling fleet with the KC-46A fleet. This project consisits of the beddown of the new KC-46A fleet at Pease Air National Guard Station in Portsmouth, NH.

I have attached my "No Objection" letter to this email.

Thank you for consulting with the Penobscot Nation on this project.

Sincerely,

Chris Sockalexis, THPO
Penobscot Nation

2

PENOBSCOT NATION
CULTURAL & HISTORIC PRESERVATION DEPARTMENT
12 WABANAKI WAY, INDIAN ISLAND, ME 04468
CHRIS SOCKALEXIS – TRIBAL HISTORIC PRESERVATION OFFICER
E-MAIL: chris.sockalexis@penobscotnation.org FAX: 207-817-7450

NAME	Christopher Eck
ADDRESS	Air National Guard NGB/A7AM Shepperd Hall 3501 Fetchet Avenue Joint Base Andrews, MD 20762
OWNER'S NAME	United States Air Force
TELEPHONE	(240) 612-7482
FAX	
EMAIL	Christopher.Eck.1@ang.af.mil
PROJECT NAME	Replace existing KC-135 air refueling fleet with the KC-46A at Pease ANGS, New Hampshire
PROJECT SITE	Portsmouth, NH
DATE OF REQUEST	September 24, 2013
DATE REVIEWED	December 31, 2013

Thank you for the opportunity to comment on the above referenced project. This project appears to have no impact on a structure or site of historic, architectural or archaeological significance to the Penobscot Nation as defined by the National Historic Preservation Act of 1966, and subsequent updates.

Also, if Native American cultural materials are encountered during the course of the project, please contact me at (207) 817-7471. Thank you.

CHRIS SOCKALEXIS, THPO
Penobscot Nation

-----Original Message-----
From: Crystal Douglas [mailto:crystal_douglas@kawnation.com]
Sent: Friday, November 22, 2013 5:09 PM
To: Eck, Christopher R Civ USAF ANG NGB/A7AM
Subject: [MALWARE FREE]RE: Air National Guard KC-46A Follow-Up

Thank you for the information, The Kaw Nation was in this area in the late 1700s and early 1800s. We would like you to notify us if you discover any human remains or culturally affiliated artifacts. We have no objecting to this endeavor we hope you will be able to progress on schedule.

Crystal Douglas
Tribal Historic Preservation Officer
Kaw Nation

-----Original Message-----
From: Clint [mailto:clint.halftown@gmail.com]
Sent: Saturday, January 11, 2014 1:24 AM
To: Eck, Christopher R Civ USAF ANG NGB/A7AM
Subject: Re: Air National Guard KC-46A Follow-Up

Dear Mt. ECM,

Greetings from the Cayuga Nation.

While I believe the proposed project will not have an adverse impact upon cultural items possible it'll related to the Cayuga Nation.

If you should come into contact with with any items, I wish for you to contact me immediately

If possible, I would like to view this proposed site.

Any questions, please contact me at 315-568-0750.

Oneh,

Clint Halftown
Cayuga Nation

Sent from my iPad

1

-----Original Message-----
From: Sherry White [mailto:sherry.white@mohican-nsn.gov]
Sent: Wednesday, January 22, 2014 5:12 PM
To: Eck, Christopher R Civ USAF ANG NGB/A7AM
Subject: RE: US Air Force Replacement of KC-135 Air Refueling Fleet Aircraft with KC-46A Aircraft

Mr. Eck
Thank you for providing me this information. The Stockbridge-Munsee Tribe has no concern with this project and agrees that no adverse effect will take place.
Sherry White
Tribal Historic Preservation Officer

Appendix B3

State Historic Preservation Office (SHPO) Correspondence

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

NGB/A7AM 12 September 2013

Jennie Chinn
Kansas State Historical Society
Cultural Resources Division
6425 SW 6th Ave
Topeka, KS 66615-1099

Dear Ms. Chinn

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified locations for the beddown of a formal training unit (FTU) and the first main operating base (MOB 1), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second main operating base (MOB 2), which will be led by an Air National Guard (ANG) unit.

There are two separate Environmental Impact Statements (EISs) being prepared for the MOB 1/FTU[1] and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action. This correspondence is provided to initiate consultation with your office, pursuant to 36 Code of Federal Regulations (CFR) 800.3 for the Undertaking. Section 106 consultation for this project will be parallel to, but conducted separately from the EIS.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including Forbes ANGS in Kansas (Attachment 1). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A at Forbes ANGS as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change to the mix of aircraft using the associated airspace; changes to

[1] The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

staffing and manpower at the selected location; changes to the number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this undertaking.

At Forbes ANGS, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. The purpose of this correspondence is to initiate the Section 106 process of the National Historic Preservation Act (NHPA) as outlined in 36 CFR 800.3.

The National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this undertaking to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Construction includes options for some of the facilities, but in general there would be an addition to Hangar 662; either interior modifications or an addition to Hangar 665; internal renovations to Building 679; and an addition and demolition of fuel hydrants and associated fuel lines on the aircraft parking apron. Specific interior renovations to Building 679 include adding shelving, altering ceiling panels, removing and constructing interior walls, and addition of stairs and railings.

The entire Forbes ANGS has been surveyed for archaeological resources (KS ANG 2008). This cultural resources survey also included an inventory and evaluations of architectural resources at the Forbes ANGS and as a result, one building (Building 679) was determined eligible for inclusion in the NRHP under Criteria A and C for its contributions to the US military Cold War mission (Zollner 2008). A Memorandum of Agreement was signed regarding Building 679 in 2009 and in 2010 the building was entirely remodeled following the completion of mitigation measures suggested and approved by your office. For this undertaking, minor interior renovations are proposed to Building 679, which would not affect the current displays erected as part of the earlier mitigation for this building (Attachment 3).

The NGB has identified no potential adverse effects to Building 679. Therefore, it is anticipated that no sites or buildings considered eligible for the NRHP would be affected by the proposed undertaking. We request your concurrence with the proposed APE, our identification of historic properties, and our assessment on the effects of this proposal on historic properties.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 4), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

The NGB is in the process of consulting with federally recognized American Indian Tribes concerning the Undertaking (Attachment 5). We are also contacting the public and relevant regional Archaeological Society offices both through the NEPA process and through Section 106 of the NHPA. All comments we receive, and any concerns expressed to the NGB, will be taken into consideration while planning for this undertaking. Please send your recommendations to the KC-46A MOB 2 Project Manager, Ms. Anne Rowe, at anne.rowe.ctr@ang.af.mil. If you have any questions regarding this consultation, Ms. Rowe can also be reached at (240) 612-8636.

Sincerely

RL Dogan

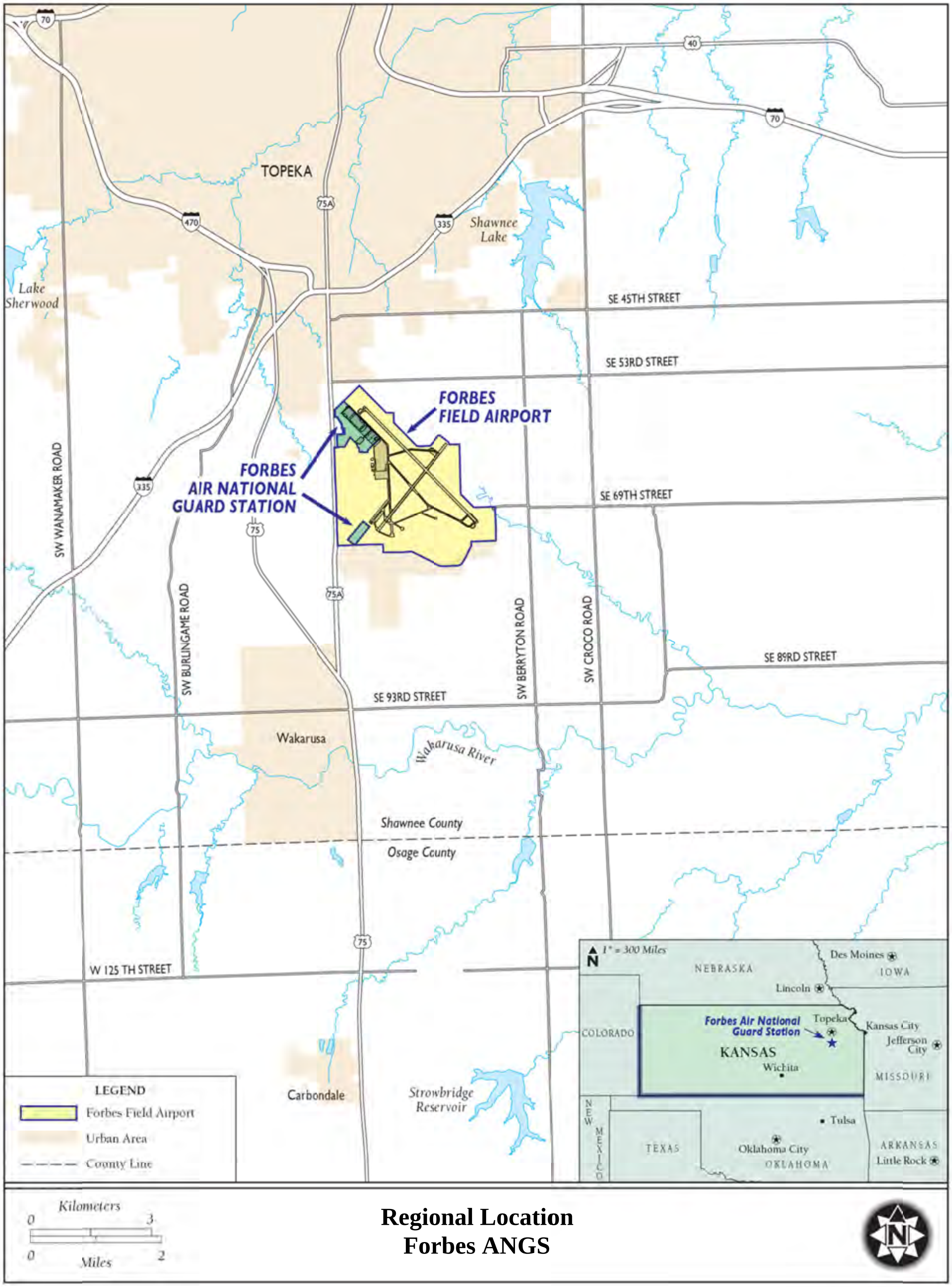
ROBERT L. DOGAN, REM, GS-13
Plans and Requirements Branch

Attachments: 1 – Vicinity map of Forbes ANGS
2 – Map of Area of Potential Effect
3 – Plans of interior renovations to Building 679
4 – Draft Description of the Proposed Action and Alternatives
5 – Federally Recognized Tribes Associated with Forbes ANGS

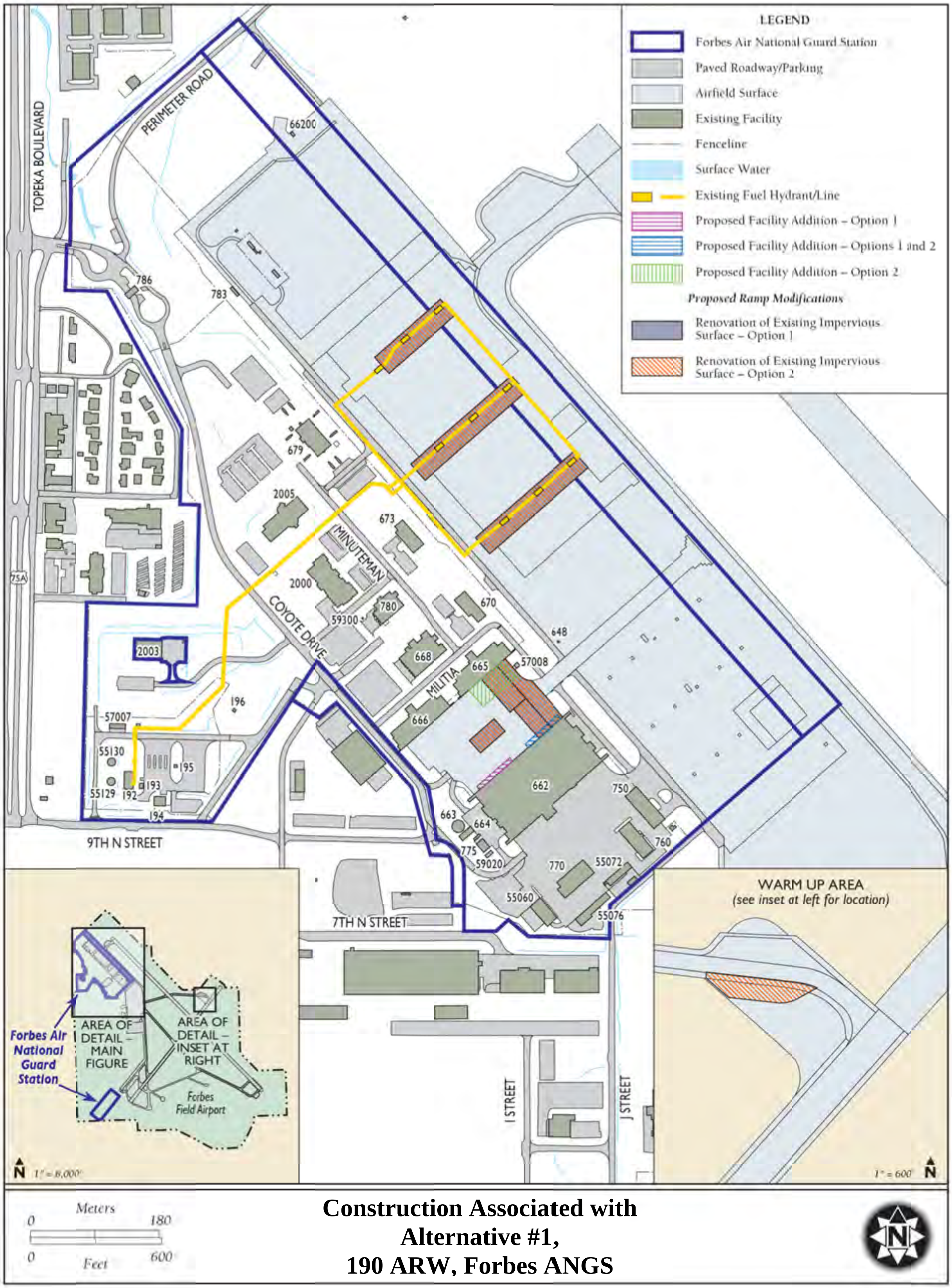
References:

Kansas Air National Guard (KS ANG)
2008 *Cultural Resources Survey and Evaluation Report for Kansas Air National Guard Properties at Forbes Field, Topeka, Kansas.* Prepared for Kansas Air National Guard and Air National Guard, National Guard Bureau. June 2008.

Zollner, Patrick
2008 Letter to Majorie Nowick, Engineering-Environmental Management, Inc. from Patrick Zollner, Director, Cultural Resources Division, Deputy SHPO. Regarding Cultural Resources Survey of Forbes Field Air National Guard Base, Shawnee County. June 18, 2008.



Regional Location
Forbes ANGS



Construction Associated with Alternative #1, 190 ARW, Forbes ANGS

Forbes ANGS Federally-recognized Tribes:

Citizen Potawatomi Nation
Kelli Mosteller, THPO
1601 S. Gordon Cooper Drive
Shawnee, OK 74801
(405) 878-5830
kelli.mosteller@potawatomi.org

John Barrett, Chairman
1601 S. Gordon Cooper Drive
Shawnee, OK 74801
(405) 275-3121
jbarrett@potawatomi.org

Delaware Nation
Tamara Francis, THPO
31064 US Highway 281, Bldg. 100
Anadarko, OK 73005

Kerry Holton, President
P.O. Box 825
Anadarko, OK 73005
(405) 247-2448
nhorn@delawarenation.com

Kaw Nation
Guy Munroe, Chairman
Drawer 50
Kaw City, OK 74641
(580) 269-2552
gmunroe@kawnation.com

Osage Nation of Oklahoma
Dr. Andrea A. Hunter, THPO
627 Grandview
Pawhuska, OK 74056
Office - 918-287-5328

Mr. John D. Redeagle, Principal Chief
P.O. Box 779
627 Grandview
Pawhuska, OK 74056
918-287-5555
jredeagle@osagetribe.org

Prairie Band of Potawatomi Nation
Steve Ortiz, Chairperson
16281 Q Road
Mayetta, KS 66509
(785) 966-4007
steveo@pbpnation.org

Absentee Shawnee Tribe of Oklahoma
George Blanchard, Governor
2025 S. Gordon Cooper Drive
Shawnee, OK 74801
(405) 275-4030 (405) 273-4534
gblanchard@astribe.com

Henryetta Ellis, THPO
2025 S. Gordon Cooper Drive
Shawnee, OK 74801
(405) 275-4030 ext. 199
hellis@astribe.com

Eastern Shawnee Tribe of Oklahoma
Glenna Wallace, Chief
12755 South 705 Rd.
Wyandotte, OK 74370
(918) 666-2435
gjwallace@estoo.net

Wichita and Affiliated Tribes
Leslie Standing, President
P.O. Box 729
Anadarko, OK 73005
(405) 247-2425 ext. 3
leslie.standing@wichitatribe.com

6425 SW 6th Avenue
Topeka, KS 66615

Kansas

phone: 785-272-8681
fax: 785-272-8682
cultural_resources@kshs.org

Kansas Historical Society

Sam Brownback, Governor
Jennie Chinn, Executive Director

KSR&C # 13-09-125
September 17, 2013

Ms. Anne Rowe
National Guard Bureau
Via Email

Re: KC-46A MOB 2 Forbes Field, Topeka – Shawnee County

We have reviewed the materials received September 17, 2013 regarding the above-referenced project in accordance with 36 CFR Part 800. In reviews of this nature, the SHPO determines whether a federally funded, licensed, or permitted project will adversely affect properties that are listed or determined eligible for listing in the National Register of Historic Places. The SHPO concurs with the proposed APE and that no historic properties will be affected by the project. As far as this office is concerned, the project may proceed.

Thank you for giving us the opportunity to comment on this proposal. Please refer to the Kansas State Review & Compliance number (KSR&C#) listed above on any future correspondence. Please submit any comments or questions regarding this review to Kim Gant at 785-272-8681, ext. 225 or kgant@kshs.org.

Sincerely,

Jennie Chinn
State Historic Preservation Officer

Patrick Zollner

Patrick Zollner
Director, Cultural Resources Division
Deputy State Historic Preservation Officer

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

NGB/A7AM 12 September 2013

Mr. Daniel Saunders
New Jersey Department of Environmental Protection
Historic Preservation Office
PO Box 420
Trenton, NJ 08625-420

Dear Mr. Saunders

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified locations for the beddown of a formal training unit (FTU) and the first main operating base (MOB 1), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second main operating base (MOB 2), which will be led by an Air National Guard (ANG) unit.

There are two separate Environmental Impact Statements (EISs) being prepared for the MOB 1/FTU[1] and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action. This correspondence is provided to initiate consultation with your office, pursuant to 36 Code of Federal Regulations (CFR) 800.3 for the Undertaking. Section 106 consultation for this project will be parallel to, but conducted separately from the EIS.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including JB MDL in New Jersey (Attachment 1). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A at JB MDL as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the

[1] The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

selected installation; a change to the mix of aircraft using the associated airspace; changes to staffing and manpower at the selected location; changes to the number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this undertaking.

At JB MDL, the KC-46A would replace the KC-135 currently based at the installation. The KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. The purpose of this correspondence is to initiate the Section 106 process of the National Historic Preservation Act (NHPA) as outlined in 36 CFR 800.3.

The National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this undertaking to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Specifically, these activities would include an addition to Hangar 3333, an addition to Hangar 3336, interior renovations to Hangar 3332, construction of a new 6,700 square foot simulator building west of Building 3390, modifications/additions to the existing aircraft ramp and taxiway, and the addition of eight new fuel hydrants and associated fuel lines on the aircraft parking apron.

The entire McGuire AFB and associated off-base facilities have been surveyed for archaeological resources (Headquarters Air Mobility Command [HQ AMC] 1995). The 1995 survey also included an architectural survey of all buildings and structures built prior to 1947, and the Semi-Automatic Ground Environmental (SAGE) complex built in 1956. As a result of this survey and follow up surveys conducted in 1996 (AMC 1996, Holmes 1996), 1997 (Holmes *et al*. 1997, McGuire AFB 2003), and 1998 (Holmes and Goar 1998), the SAGE complex, the Boeing Michigan Aeronautical Research Center (BOMARC) complex at Fort Dix, and three historic archaeological sites were recommended eligible for inclusion in the National Register of Historic Places (NRHP). No other buildings or sites were recommended eligible. The cultural resources recommended eligible for the NRHP at McGuire AFB are all well outside the proposed APE for the undertaking. Additionally, according to the McGuire AFB Integrated Cultural Resources Management Plan (JB MDL 2013) the proposed APE occurs in an area of low archaeological sensitivity.

The NGB has identified no potential adverse effects as a result of this undertaking. We request your concurrence with the proposed APE, our identification of historic properties, and our assessment on the effects of this proposal on historic properties.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 3), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

The NGB is in the process of consulting with federally recognized American Indian Tribes concerning the Undertaking (Attachment 4). We are also contacting the public and relevant regional Archaeological Society offices both through the NEPA process and through Section 106 of the NHPA. All comments we receive, and any concerns expressed to the NGB, will be taken into consideration while planning for this undertaking. Please send your recommendations to the KC-46A MOB 2 Project Manager, Ms. Anne Rowe, at anne.rowe.ctr@ang.af.mil. If you have any questions regarding this consultation, Ms. Rowe can also be reached at (240) 612-8636.

Sincerely

ROBERT L. DOGAN, REM, GS-13
Plans and Requirements Branch

Attachments: 1 – Vicinity map
2 – Map of Area of Potential Effect
3 – Draft Description of the Proposed Action and Alternatives
4 – Federally Recognized Tribes associated with JB MDL

References:

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Headquarters Air Mobility Command (HQ AMC)
1995 *An Archaeological and Historical Resources Inventory of McGuire Air Force Base, New Jersey*. Prepared by Moeller, K.L., D.A. Walitschek, M. Greby, and J.F. Hoffecker of the Argonne National Laboratory for McGuire AFB.

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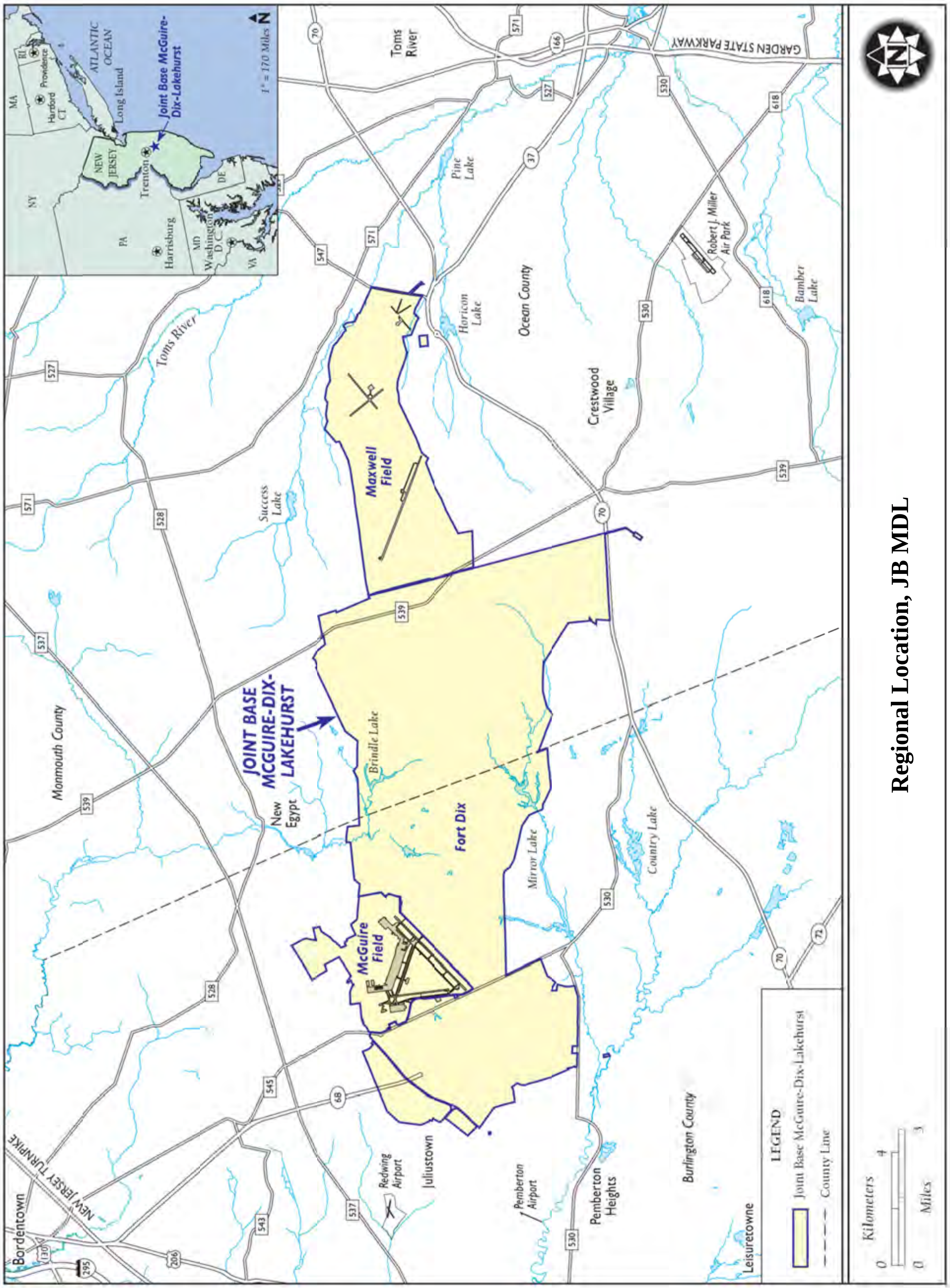
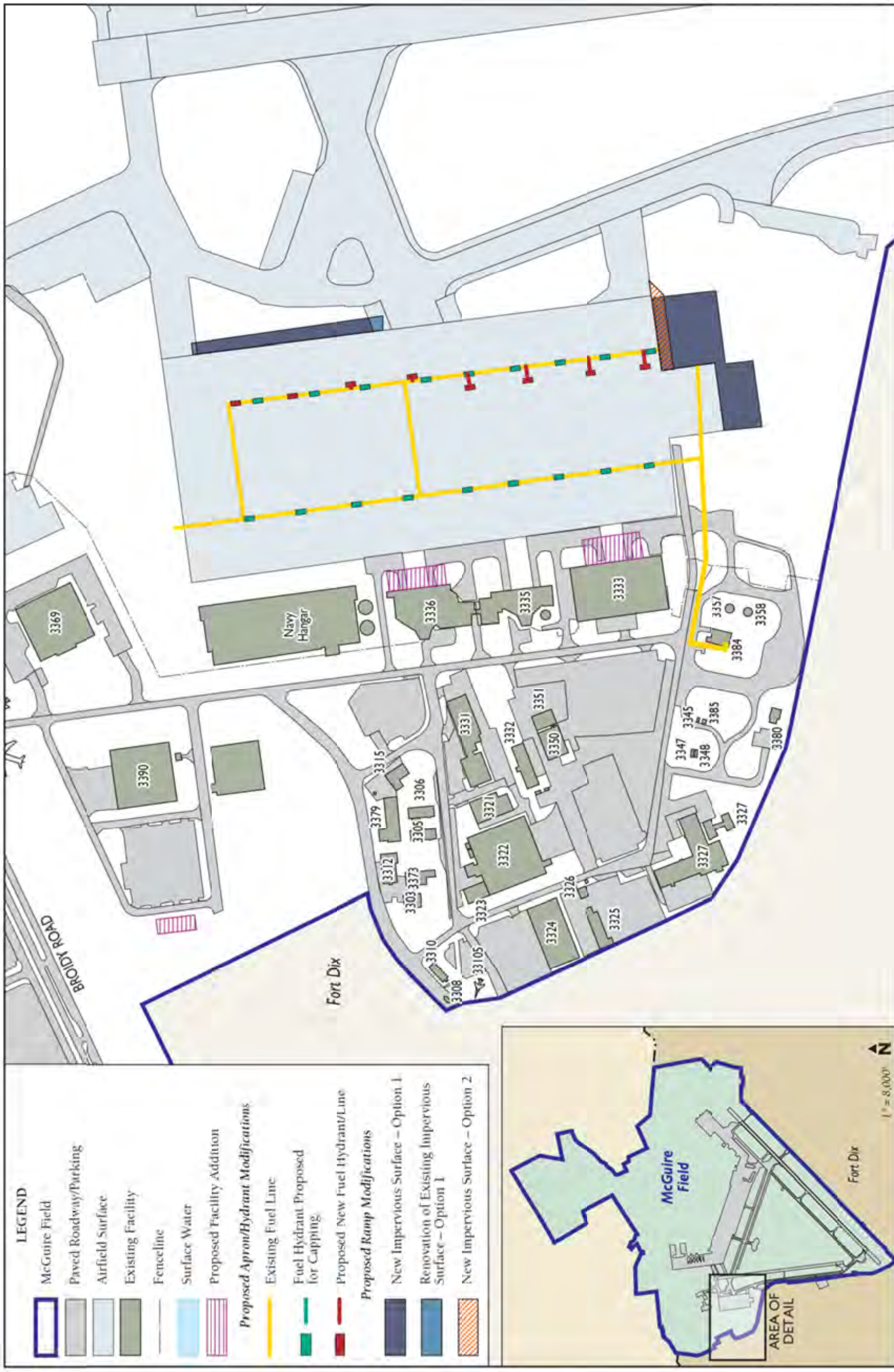
Joint Base McGuire-Dix-Lakehurst (JB MDL)
2013 *Draft Integrated Cultural Resources Management Plan*. 87 CES/CEAN, JB MDL, New Jersey. January 2013.

McGuire Air Force Base (AFB)
2003 *Final Integrated Cultural Resources Management Plan*. Prepared 2003. Updated July 2005.



Regional Location, JB MDL
JOINT BASE MCGUIRE-DIX-LAKEHURST
Maxwell Field
Fort Dix
McGuire Field
Joint Base McGuire-Dix-Lakehurst
ATLANTIC OCEAN
NEW JERSEY
Trenton
Long Island
Harrisburg
Washington D.C.
1" = 170 Miles
Toms River
Ocean County
Monmouth County
Burlington County
Crestwood Village
Success Lake
Brindle Lake
Mirror Lake
Country Lake
Horicon Lake
Pine Lake
Bamber Lake
Robert J. Miller Air Park
New Egypt
Juliustown
Redwing Airport
Pemberton Airport
Pemberton Heights
Leisuretowne
Bordentown
NEW JERSEY TURNPIKE
GARDEN STATE PARKWAY
LEGEND
County Line
Kilometers
Miles



Construction Associated with Alternative #2, 108 WG Installation, JB MDL

Meters 0 150
Feet 0 500

McGuire Federally-Recognized Tribes:

Delaware Nation
Tamara Francis, THPO
31064 US Highway 281, Bldg. 100
Anadarko, OK 73005

Kerry Holton, President
PO Box 825
Anadarko, OK 73005
(405) 247-2448
nhorn@delawarenation.com

Delaware Tribe of Indians
Dr. Brice Obermeyer, THPO
Department of Sociology and Anthropology, Emporia State University
Roosevelt Hall, Rm. 212
1200 Commercial St.
Emporia, KS 66801

Paula Pechonick, Chief
170 NE Barbara
Bartlesville, OK 74006
(918) 337-6593
ppechonick@delawaretribe.org

Chester Brooks, Trust Board Chairman
170 NE Barbara
Bartlesville, OK 74006
(918) 337-6590
cbrooks@delawaretribe.org

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

HPO-J2013-045
13-1101-2GR

NGB/A7AM

12 September 2013

RECEIVED

SEP 17 2013

HISTORIC PRESERVATION OFFICE

Mr. Daniel Saunders
New Jersey Department of Environmental Protection
Historic Preservation Office
PO Box 420
Trenton, NJ 08625-420

Dear Mr. Saunders

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HPO Project # 13-1101-2
HPO- J2013-045

Page 2

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The NGB has identified no potential adverse effects as a result of this undertaking. We request your concurrence with the proposed APE, our identification of historic properties, and our assessment on the effects of this proposal on historic properties.

HPO Project# 13-1101-2
HPO-J2013-045

Page 3

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The NGB is in the process of consulting with federally recognized American Indian Tribes concerning the Undertaking (Attachment 4). We are also contacting the public and relevant regional Archaeological Society offices both through the NEPA process and through Section 106 of the NHPA. All comments we receive, and any concerns expressed to the NGB, will be taken into consideration while planning for this undertaking. Please send your recommendations to the KC-46A MOB 2 Project Manager, Ms. Anne Rowe, at anne.rowe.ctr@ang.af.mil. If you have any questions regarding this consultation, Ms. Rowe can also be reached at (240) 612-8636.

Sincerely

RL Dogan

ROBERT L. DOGAN, REM, GS-13
Plans and Requirements Branch

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HPO Project# 13-1101-2
HPO - J2013-045

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2013 *Draft Integrated Cultural Resources Management Plan.* 87 CES/CEAN, JB MDL, New Jersey. January 2013.

McGuire Air Force Base (AFB)
2003 *Final Integrated Cultural Resources Management Plan.* Prepared 2003. Updated July 2005.

I concur with your finding that there are no historic properties affected within the project's area of potential effects. Consequently, pursuant to 36 CFR 800.4(d)(1), no further Section 106 consultation is required unless additional resources are discovered during project implementation pursuant to 36 CFR 800.13.

10/3/13
Date

Deputy State Historic Preservation Officer
DANIEL D. SAUNDERS

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

NGB/A7AM

12 September 2013

Nadine Peterson
New Hampshire Division of Historical Resources
19 Pilsbury St, 2nd Floor
Concord, NH 03301

Dear Ms. Peterson

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified locations for the beddown of a formal training unit (FTU) and the first main operating base (MOB 1), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second main operating base (MOB 2), which will be led by an Air National Guard (ANG) unit.

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The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including Pease ANGS in New Hampshire (Attachment 1). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A at Pease ANGS as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change to the mix of aircraft using the associated airspace;

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changes to staffing and manpower at the selected location; changes to the number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this action.

At Pease ANGS, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. The purpose of this correspondence is to initiate the Section 106 process of the National Historic Preservation Act (NHPA) as outlined in 36 CFR 800.3.

The National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this action to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Construction activities would include: renovations and additions to Hangars 251, 252, 253, and 254; construction and upgrade of the aircraft taxiway; repaving of the quad apron; and demolition of existing fuel hydrants and associated fuel lines and installation of new hydrants and lines on the aircraft parking apron.

The entire ANGS at Pease has been surveyed for archaeological and architectural resources and no historic properties were identified (157th Air Refueling Wing [157 ARW] 2009). The NGB has identified no potential adverse effects to cultural resources as a result from this undertaking. We request your concurrence with the proposed APE, our identification of historic properties, and our assessment on the effects of this proposal on historic properties.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 3), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

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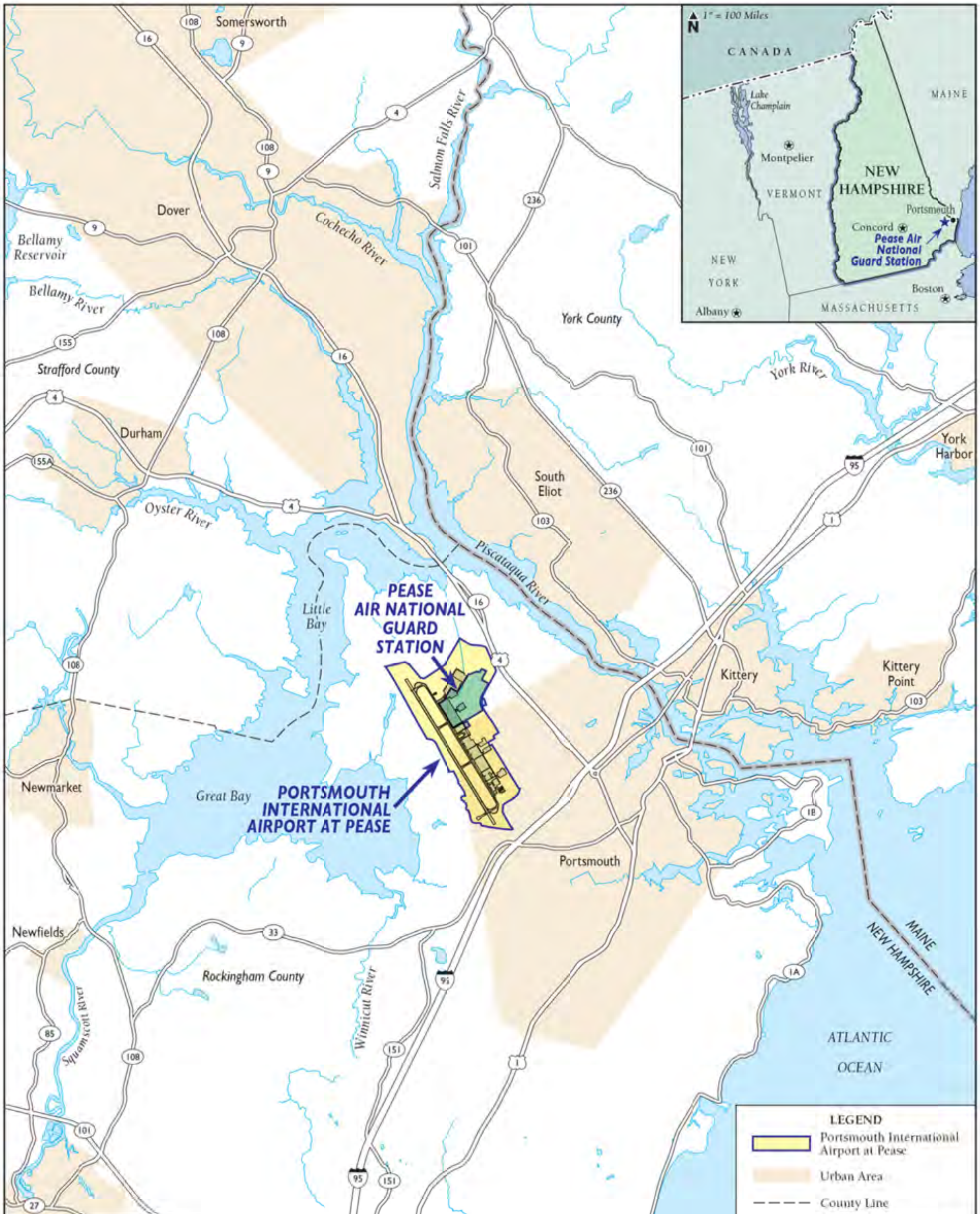
Sincerely

ROBERT L. DOGAN, REM, GS-13
Plans and Requirements Branch

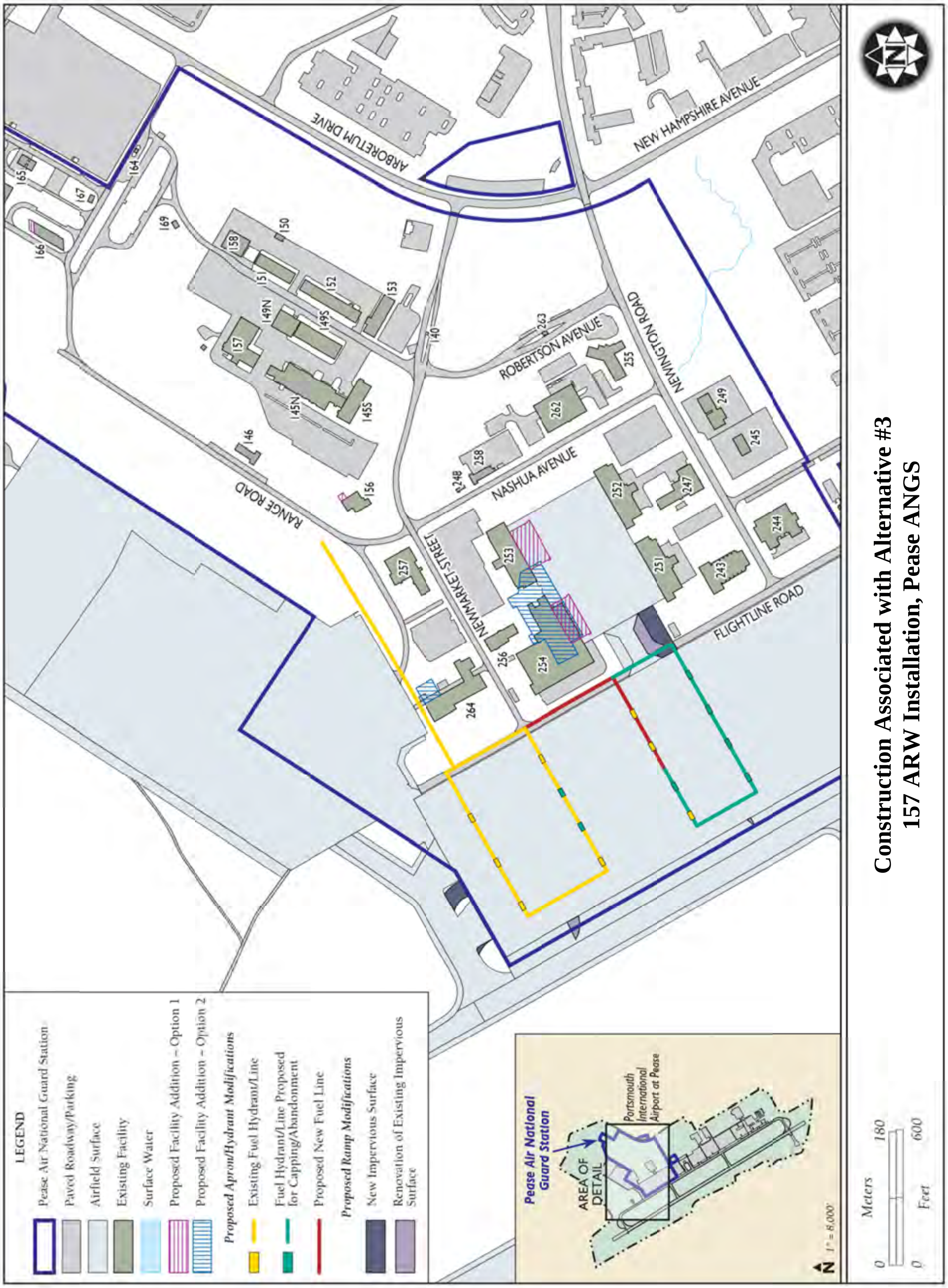
Attachments: 1 – Vicinity Map of Pease ANGS
2 – Map of the Area of Potential Effect
3 – Draft Description of the Proposed Action and Alternatives
4 – Federally Recognized Tribes associated with Pease ANGS

Reference:

157th Air Refueling Wing (157 ARW)
2009 *Cultural Resources Survey of the 157 Air Refueling Wing, New Hampshire Air National Guard, Pease International Tradeport, Town of Newington, Rockingham County, New Hampshire.* Prepared for New Hampshire Air National Guard and Air National Guard Readiness Center, National Guard Bureau. April 2009.



Regional Location
Pease ANGS


Construction Associated with Alternative #3
157 ARW Installation, Pease ANGS
LEGEND
Pease Air National Guard Station
Paved Roadway/Parking
Airfield Surface
Existing Facility
Surface Water
Proposed Facility Addition – Option 1
Proposed Facility Addition – Option 2
Proposed Apron/Hydrant Modifications
Existing Fuel Hydrant/Line
Fuel Hydrant/Line Proposed for Capping/Abandonment
Proposed New Fuel Line
Proposed Ramp Modifications
New Impervious Surface
Renovation of Existing Impervious Surface
1" = 8,000'
Pease Air National Guard Station
AREA OF DETAIL
Portsmouth International Airport at Pease
Meters 0 180
Feet 0 600
ARBORETUM DRIVE
NEW HAMPSHIRE AVENUE
NEWINGTON ROAD
ROBERTSON AVENUE
NASHUA AVENUE
NEWMARKET STREET
RANGE ROAD
FLIGHTLINE ROAD

Pease ANGS Federally-recognized Tribe:

Penobscot Indian Nation
Kirk Francis, Chief
12 Wabanaki Way
Indian Island, ME 04668
(207) 827-7776
kirk.francis@Penobscotnation.org

Bonnie Newsom, THPO
12 Wabanaki Way
Indian Island, ME 04468
(207) 817-7332
Bonnie.Newsom@penobscotnation.org

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

RECEIVED
SEP 17 2013

Newington
5126
USANG

NGB/A7AM

12 September 2013

Nadine Peterson
New Hampshire Division of Historical Resources
19 Pilsbury St, 2nd Floor
Concord, NH 03301

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Page 2

changes to staffing and manpower at the selected location; changes to the number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this action.

At Pease ANGS, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. The purpose of this correspondence is to initiate the Section 106 process of the National Historic Preservation Act (NHPA) as outlined in 36 CFR 800.3.

The National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this action to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Construction activities would include: renovations and additions to Hangars 251, 252, 253, and 254; construction and upgrade of the aircraft taxiway; repaving of the quad apron; and demolition of existing fuel hydrants and associated fuel lines and installation of new hydrants and lines on the aircraft parking apron.

The entire ANGS at Pease has been surveyed for archaeological and architectural resources and no historic properties were identified (157th Air Refueling Wing [157 ARW] 2009). The NGB has identified no potential adverse effects to cultural resources as a result from this undertaking. We request your concurrence with the proposed APE, our identification of historic properties, and our assessment on the effects of this proposal on historic properties.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 3), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

The NGB is in the process of consulting with federally recognized American Indian Tribes concerning the Undertaking (Attachment 4). We are also contacting the public and relevant regional Archaeological Society offices both through the NEPA process and through Section 106 of the NHPA. All comments we receive, and any concerns expressed to the NGB,

will be taken into consideration while planning for this undertaking. Please send your recommendations to the KC-46A MOB 2 Project Manager, Ms. Anne Rowe, at anne.rowe.ctr@ang.af.mil. If you have any questions regarding this consultation, Ms. Rowe can also be reached at (240) 612-8636.

Sincerely

ROBERT L. DOGAN, REM, GS-13
Plans and Requirements Branch

Attachments: 1 – Vicinity Map of Pease ANGS
2 – Map of the Area of Potential Effect
3 – Draft Description of the Proposed Action and Alternatives
4 – Federally Recognized Tribes associated with Pease ANGS

Reference:

157th Air Refueling Wing (157 ARW)
2009 *Cultural Resources Survey of the 157 Air Refueling Wing, New Hampshire Air National Guard, Pease International Tradeport, Town of Newington, Rockingham County, New Hampshire.* Prepared for New Hampshire Air National Guard and Air National Guard Readiness Center, National Guard Bureau. April 2009.

Conditions required for NEPA & Section 106 of the NHPA have been met.
_____ No Known Historic Resources
__✓__ No Resources Present
_____ No Adverse Effect
If plans change or resources are discovered in the course of this project, you must contact the Division of Historical Resources as required by federal law and regulation.
E.H.Muzzey 9/30/13
NH State Historic Preservation Officer

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

NGB/A7AM 12 September 2013

Doug McLearen and Kira Heinrich
Archaeology & Protection Division
Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Commonwealth Keystone Building
400 North St
Harrisburg, PA 17120

Dear Mr. McLearen and Ms. Heinrich

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified locations for the beddown of a formal training unit (FTU) and the first main operating base (MOB 1), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second main operating base (MOB 2), which will be led by an Air National Guard (ANG) unit.

There are two separate Environmental Impact Statements (EISs) being prepared for the MOB 1/FTU[1] and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action. This correspondence is provided to initiate consultation with your office, pursuant to 36 Code of Federal Regulations (CFR) 800.3 for the Undertaking. Section 106 consultation for this project will be parallel to, but conducted separately from the EIS.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including Pittsburgh ANGS in Pennsylvania (Attachment 1). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A at Pittsburgh ANGS as a replacement

[1] The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change to the mix of aircraft using the associated airspace; changes to staffing and manpower at the selected location; changes to the number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this undertaking.

At Pittsburgh ANGS, the KC-46A would replace the KC-135 currently based at the installation. Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. The purpose of this correspondence is to initiate the Section 106 process of the National Historic Preservation Act (NHPA) as outlined in 36 CFR 800.3.

The National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this undertaking to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Construction activities would include: an addition to Hangar 302; an addition to Hangar 320; interior renovations to Hangar 301; modifications to the aircraft ramp and taxiway; and the addition of eight new fuel hydrants and associated fuel lines on the aircraft parking apron; and possible demolition or capping of existing fuel hydrants and lines on the parking apron.

The entire Pittsburgh ANGS has been surveyed for archaeological and architectural resources and no historic properties were identified (Cardno TEC, Inc. 2011). Therefore, it is anticipated that no sites or buildings considered eligible for the NRHP would be affected by the proposed undertaking. We request your concurrence with the proposed APE, our identification of historic properties, and our assessment on the effects of this proposal on historic properties.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 3), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

The NGB is in the process of consulting with federally-recognized American Indian Tribes concerning the Undertaking (Attachment 4). We are also contacting the public and relevant regional Archaeological Society offices both through the NEPA process and through Section 106 of the NHPA. All comments we receive, and any concerns expressed to the NGB,

will be taken into consideration while planning for this undertaking. Please send your recommendations to the KC-46A MOB 2 Project Manager, Ms. Anne Rowe, at anne.rowe.ctr@ang.af.mil. If you have any questions regarding this consultation, Ms. Rowe can also be reached at (240) 612-8636.

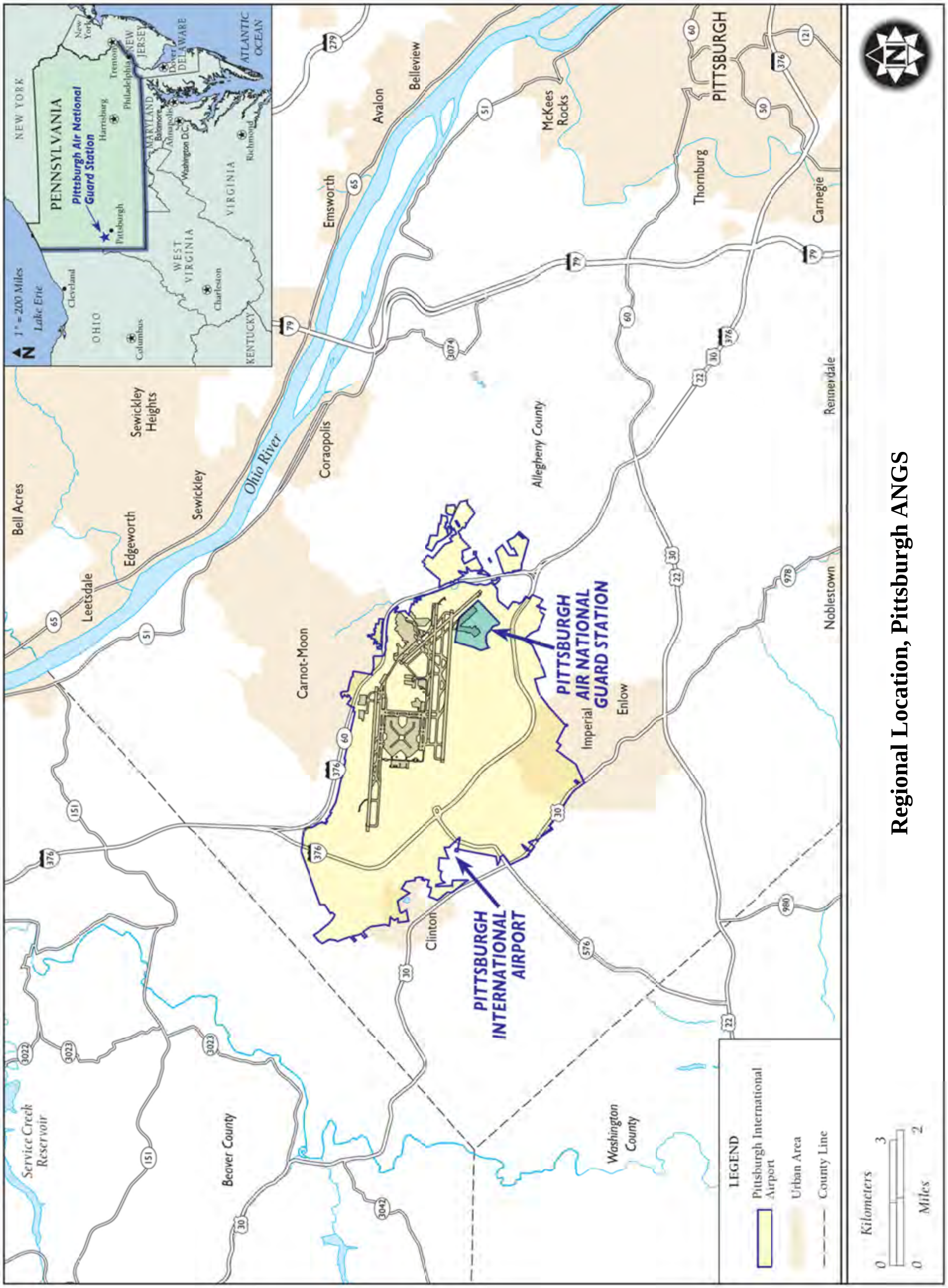
Sincerely

ROBERT L. DOGAN, REM, GS-13
Plans and Requirements Branch

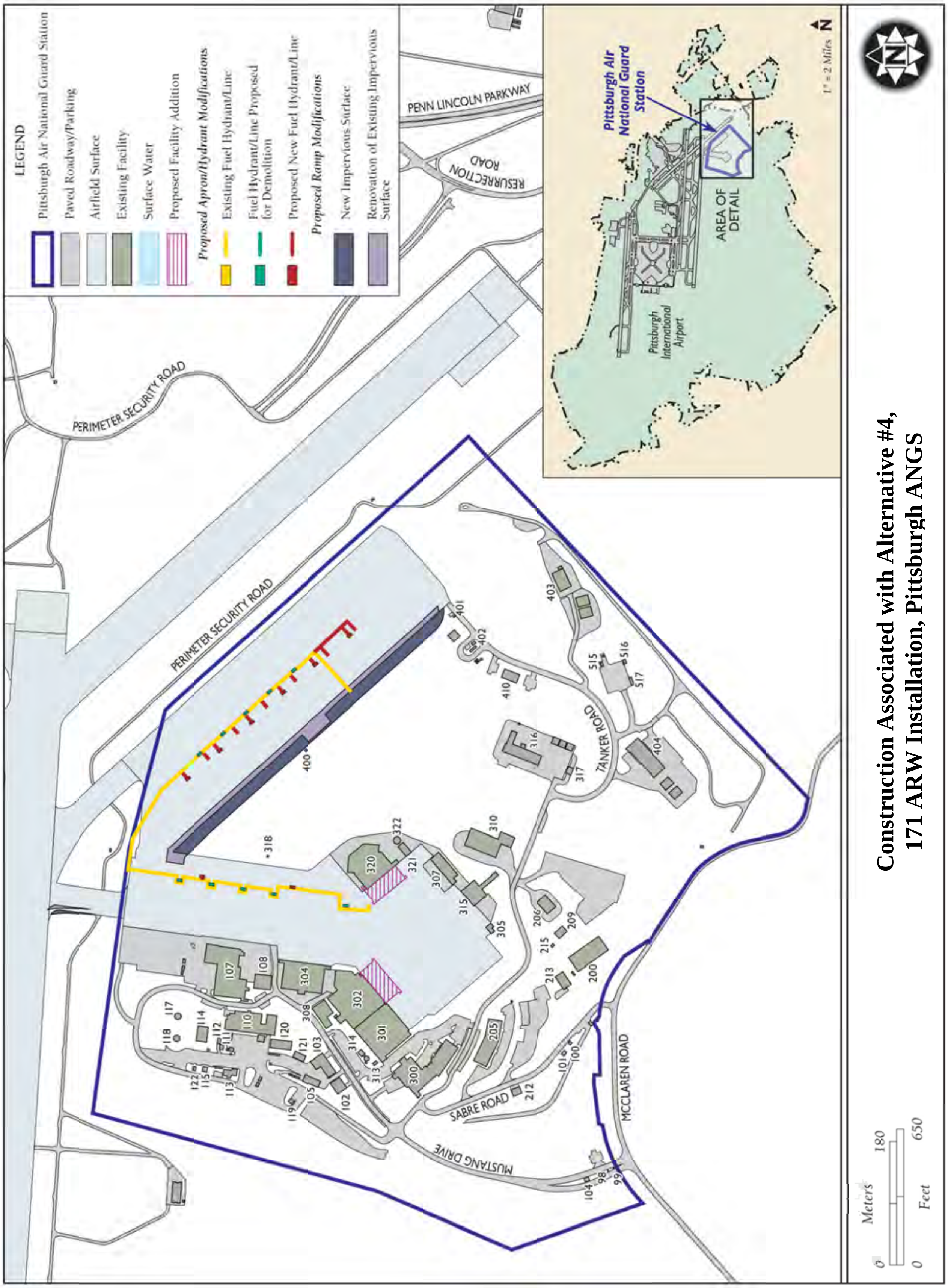
Attachments: 1 – Vicinity Map of Pittsburgh ANGS
2 – Map of the Area of Potential Effect
3 – Draft Description of the Proposed Action and Alternatives
4 – Federally Recognized Tribes associated with Pittsburgh ANGS

Reference:

Cardno TEC, Inc.
2011 *Cultural Resources Survey at the 171 Air Refueling Wing, Pittsburgh, Pennsylvania*. Prepared by TEC.



Regional Location, Pittsburgh ANGS


LEGEND
Pittsburgh Air National Guard Station
Paved Roadway/Parking
Airfield Surface
Existing Facility
Surface Water
Proposed Facility Addition
Proposed Apron/Hydrant Modifications
Existing Fuel Hydrant/Line
Fuel Hydrant/Line Proposed for Demolition
Proposed New Fuel Hydrant/Line
Proposed Ramp Modifications
New Impervious Surface
Renovation of Existing Impervious Surface
PENN LINCOLN PARKWAY
RESURRECTION ROAD
PERIMETER SECURITY ROAD
PERIMETER SECURITY ROAD
TANKER ROAD
SABRE ROAD
MUSTANG DRIVE
MCCLAREN ROAD
Pittsburgh Air National Guard Station
AREA OF DETAIL
Pittsburgh International Airport
1" = 2 Miles
N
Meters
0
180
Feet
0
650
Construction Associated with Alternative #4,
171 ARW Installation, Pittsburgh ANGS

Pittsburgh ANGS Federally-recognized Tribes:

Cayuga Nation of New York
Melinda Maybee, Nation Representative
PO Box 803
Seneca Falls, NY
13148
(315) 586-0750

Onondaga Nation of New York
Irving Powless, Chief
RRT#1, PO Box 319-B
Nedrow, NY 13120
(315) 492-1922

Tuscarora Nation of New York
Leo Henry, Chief
2006 Mt. Hope Rd.
Lewiston, NY 14092
(716) 297-1148

Seneca Nation of Indians
Robert Odawi Porter, President
12837 Rte. 438
Irving, NY 14081
(716) 532-4900
robert.porter@sni.org

Lana Watt, THPO
90 Ohi Yoho Way
Salamanca, NY 14779
(716) 945-1790 ext. 3580
Lana.watt5@sni.org

Tonawanda Band of Seneca
Roger Hill, Chief
7027 Meadville Road
Basom, NY 14013
(716) 542-4244
tonseneca@aol.com

NATIONAL GUARD BUREAU
3501 FETCHET AVENUE
JOINT BASE ANDREWS MD 20762-5157

NGB/A7AM 12 September 2013

Lisa Adkins
Ohio Historic Preservation Office
800 E 17th Ave
Columbus, OH 43211-2474

Dear Ms. Adkins

The United States Air Force (USAF) plans to replace the existing KC-135 air refueling fleet with the KC-46A, which will be a new aircraft to the USAF's fleet. As such, the USAF has identified locations for the beddown of a formal training unit (FTU) and the first main operating base (MOB 1), which will both be led by active duty units. The USAF will also beddown the KC-46A at the second main operating base (MOB 2), which will be led by an Air National Guard (ANG) unit.

There are two separate Environmental Impact Statements (EISs) being prepared for the MOB 1/FTU[1] and MOB 2 beddowns. While you may be familiar with either or both of these actions, this particular letter is in reference only to the MOB 2 beddown action. This correspondence is provided to initiate consultation with your office, pursuant to 36 Code of Federal Regulations (CFR) 800.3 for the Undertaking. Section 106 consultation for this project will be parallel to, but conducted separately from the EIS.

The MOB 2 alternative locations for this beddown include:

- Forbes Air National Guard Station (ANGS), Kansas;
- Joint Base McGuire-Dix-Lakehurst (JB MDL), New Jersey;
- Pease ANGS, New Hampshire;
- Pittsburgh ANGS, Pennsylvania; and,
- Rickenbacker ANGS, Ohio.

The EIS is being prepared under the National Environmental Policy Act (NEPA) for the potential beddown of the KC-46A at one of the five alternative locations, including Rickenbacker ANGS in Ohio (Attachment 1). The EIS will assess the potential environmental consequences associated with the beddown of the KC-46A at Rickenbacker ANGS as a replacement to the KC-135. As a result of the Proposed Action, there would be a change to the type of aircraft based at the selected installation; a change to the mix of aircraft using the associated airspace; changes to staffing and manpower at the selected location; changes to the

[1] The FTU alternative installations include Altus Air Force Base (AFB), Oklahoma and McConnell AFB, Kansas. The MOB 1 alternative installations include Altus AFB, Oklahoma; McConnell AFB, Kansas; Fairchild AFB, Washington; and Grand Forks AFB, North Dakota.

number of airfield operations; as well as minor required construction, building renovation, and facility demolition. There would be no new or modified airspace required to support this undertaking.

At Rickenbacker ANGS, the KC-46A would replace the KC-135 currently based at the installation (Attachment 1). Under this alternative, the KC-46A would operate in existing airspace in a similar manner as is currently conducted. There may be a slight increase in operations in the airspace; however, use of this airspace is generally 10,000 feet above ground level and higher and preliminary analysis indicates that noise levels under the proposal would be similar to existing noise levels with the KC-135 aircraft. The purpose of this is correspondence is to initiate the Section 106 process of the National Historic Preservation Act (NHPA) as outlined in 36 CFR 800.3.

The National Guard Bureau (NGB) anticipates the area of potential effect (APE) for this undertaking to be limited to the portion of the installation where construction, demolition, and renovation activities would occur (Attachment 2). Construction activities would include: additions and renovations to Hangar 885; an addition to Hangar 883; interior renovations to Hangar 888; modifications to the aircraft ramp and taxiway; and addition and demolition of fuel hydrants and associated fuel lines on the aircraft parking apron.

According to cultural resources surveys conducted between 2007 and 2008, there are no archaeological sites located within the proposed APE (National Guard Bureau [NGB] 2007, NGB 2008). These surveys covered the entire Rickenbacker ANGS, including an inventory and evaluations of all buildings and structures and no significant archaeological resources were encountered. Two buildings (Hangars 885 and 888) were recommended eligible for listing on the National Register of Historic Places. Hangars 885 and 888 have been determined eligible to the NRHP under Criteria A and C (Snyder 2007). Specific changes to Hangar 885 proposed for this undertaking include a 4,000 square foot addition to provide adequate space for the larger KC-46A aircraft. Specific changes to Hangar 888 proposed for this undertaking include interior modifications only with no changes to the exterior.

The NGB has identified that a potential adverse effect to Hangar 885 may result from this undertaking. For Hangar 888, the NGB has identified no potential adverse effect from this undertaking as the renovations are interior only; however, we first request your concurrence with the proposed APE and with our identification of historic properties.

We have attached the Draft Description of the Proposed Action and Alternatives (Attachment 3), which will become the first chapters of the Draft EIS so that you may review the proposal and provide us any concerns that you may have regarding the proposal. Upon release of the Draft EIS (expected in early 2014), we will send that to you for your further review and comment.

The NGB is in the process of consulting with federally-recognized American Indian Tribes concerning the Undertaking (Attachment 4). We are also contacting the public and relevant regional Archaeological Society offices both through the NEPA process and through Section 106 of the NHPA. All comments we receive, and any concerns expressed to the NGB, will be taken into consideration while planning for this undertaking. Please send your recommendations to the KC-46A MOB 2 Project Manager, Ms. Anne Rowe, at anne.rowe.ctr@ang.af.mil. If you have any questions regarding this consultation, Ms. Rowe can also be reached at (240) 612-8636.

Sincerely

RL Dogan

ROBERT L. DOGAN, REM, GS-13
Plans and Requirements Branch

Attachments: 1 – Vicinity Map of Rickenbacker ANGS
2 – Map of Area of Potential Effect
3 – Draft Description of the Proposed Action and Alternatives
4 – Federally Recognized Tribes Associated with Rickenbacker ANGS

References:

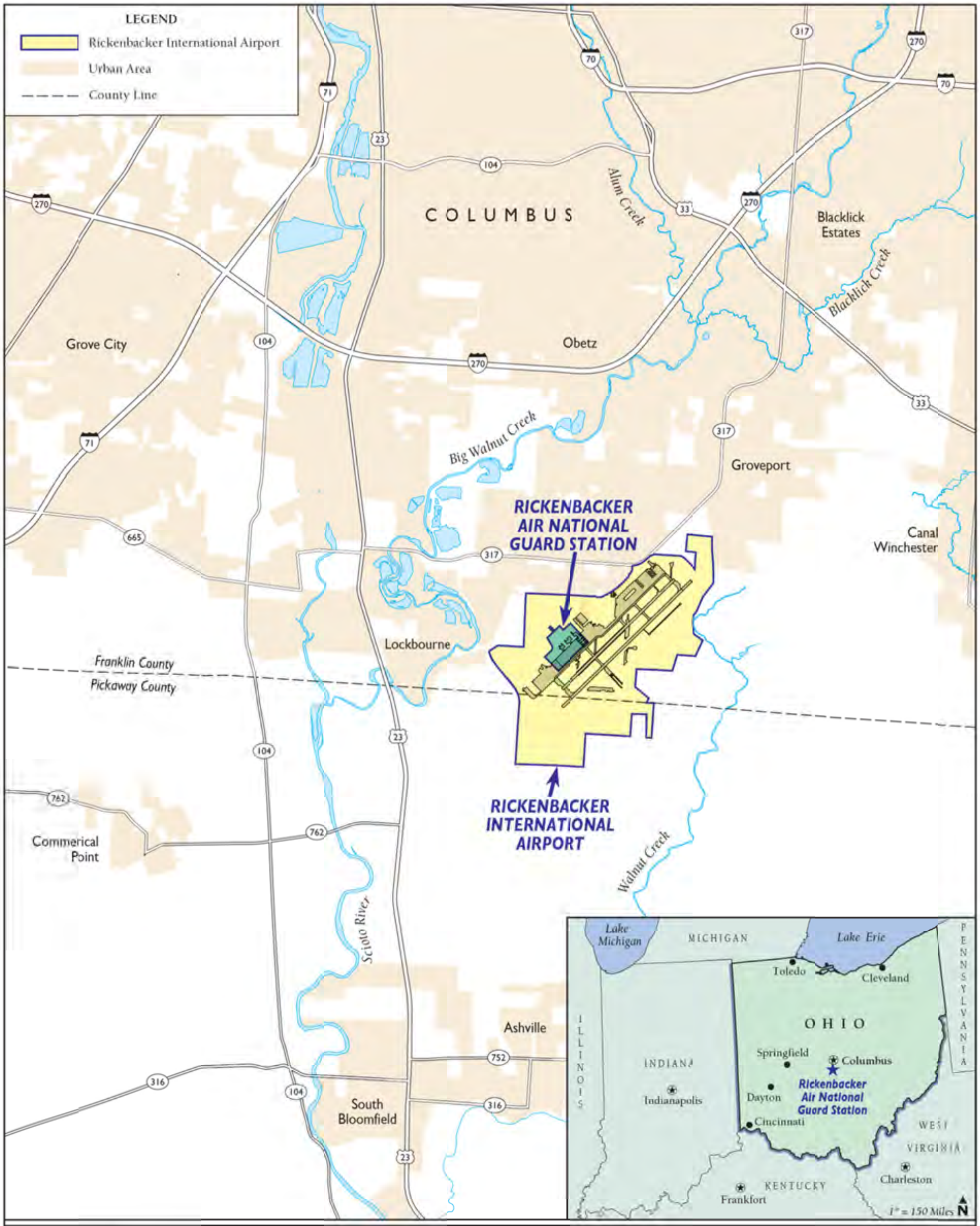
National Guard Bureau (NGB)

2007 *Cultural Resources Survey of the 121st Air Refueling Wing, Ohio Air National Guard, Rickenbacker International Airport, Columbus, Franklin County, Ohio.* Prepared for the National Guard Bureau, Air National Guard Readiness Center NGB/A7CVN, Andrews Air Force Base, Maryland. December 2007.

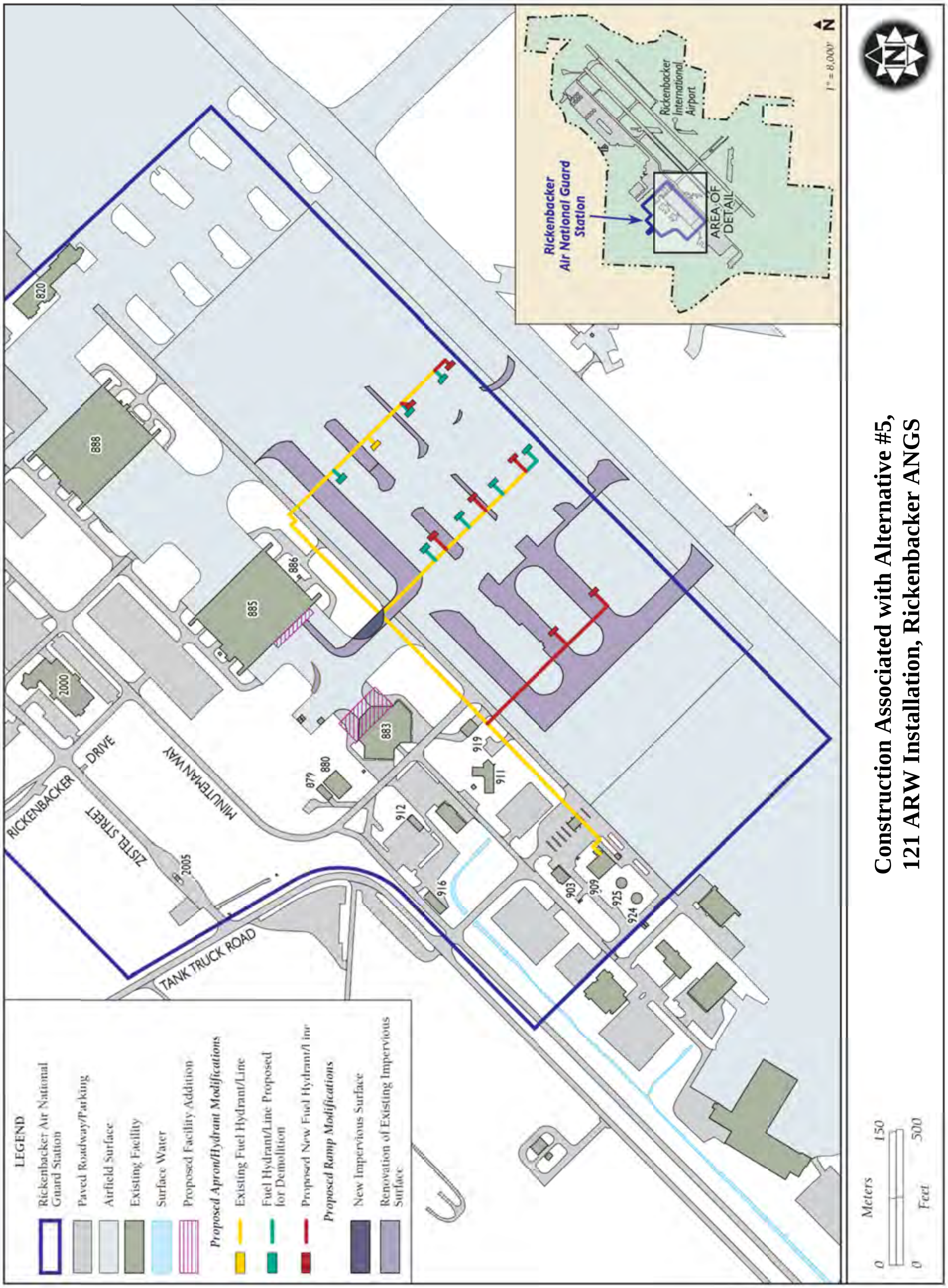
2008 *Cultural Resources Survey of the 121st Air Refueling Wing, Ohio Air National Guard, Rickenbacker International Airport, Columbus, Franklin County, Ohio.* Prepared for the National Guard Bureau, Air National Guard Readiness Center NGB/A7CVN, Andrews Air Force Base, Maryland. January 2008.

Snyder, David

2007 Letter to Matt Nowakowski, National Guard Bureau from David Snyder, Archaeology Review Manager, Resource Protection and Review, Ohio Historic Preservation Office regarding: *121 ARW Ohio ANG, Rickenbacker IAP, Draft Final Cultural Resources Survey, Hamilton Township, Franklin County, Ohio*. August 23, 2007.



Regional Location
Rickenbacker ANGS



Construction Associated with Alternative #5, 121 ARW Installation, Rickenbacker ANGS

Rickenbacker Federally-recognized Tribes

Citizen Potawatomi Nation
Kelli Mosteller, THPO
1601 S. Gordon Cooper Drive
Shawnee, OK 74801
Ph (405) 878-5830
kelli.mosteller@potawatomi.org

John Barrett, Chairman
1601 S. Gordon Cooper Drive
Shawnee, OK 74801
Ph (405) 275-3121
jbarrett@potawatomi.org

Delaware Nation
Tamara Francis, THPO
31064 US Highway 281, Bldg. 100
Anadarko, OK 73005

Kerry Holton, President
P.O. Box 825
Anadarko, OK 73005
Ph (405) 247-2448
nhorn@delawarenation.com

Prairie Band of Potawatomi Nation
Steve Ortiz, Chairperson
16281 Q Road
Mayetta, KS 66509
Ph (785) 966-4007
steveo@pbpnation.org

Eastern Shawnee Tribe of Oklahoma
Glenna Wallace, Chief
12755 South 705 Rd.
Wyandotte, OK 74370
Ph (918) 666-2435
gjwallace@estoo.net

Forest County Potawatomi Community
Harold Frank, Chairman
PO Box 340
Crandon, WI 54520
Ph (715) 478-2903
jessica.gouge2@fcpotawatomi-nsn.gov

Hannahville Indian Community
Kenneth Meshigaud, Chairperson
N14911 Hannahville B1 Rd.
Wilson, MI 49896-9728
Ph (906) 723-2600
Fax (906) 466-2933
tyderyien@hannahville.org

Miami Tribe of Oklahoma
George Strack, THPO
PO Box 1326
Miami, OK 74355
(918) 542-1445

Thomas Gamble, Chairperson
PO Box 1326
Miami, OK 74355-1326
(918) 542-1445

Ottawa Tribe of Oklahoma
Ethel E. aa Cooka, Chief
PO Box 110
Miami, OK 74355
Ph (918)540-1536
Fax (918) 542-3214
Dixon_rhonda@sbcglobal.net

Peoria Tribe of Indians of Oklahoma
John P. Froman, Chief
PO Box 1527
Miami, OK 74355
Ph (918) 540-2535, ext. 12
Fax (918) 540-2538
jfroman@peoriatribe.com

Pokagon Band of Potawatomi Indians
Matthew J. Wesaw, Chairman
PO Box 180
Dowagiac, MI 49047
Ph (517) 719-5579
Fax (269) 782-9625
Matthew.wesaw@pokagonbank-nsn.gov

Mike Zimmerman, THPO
PO Box 180
Dowagiac, MI 49047
Ph (269) 782-9602
Fax (269) 782-1817
Michael.zimmerman@pokagonband-nsn.gov

Shawnee Tribe
Jody Hayes, Tribe Administrator
PO Box 189
Miami, OK 74355
Ph (918) 542-2441
shawneetribes@shawnee-tribe.com

Ron Sparkman, Chairperson
PO Box 189
Miami, OK 74355
Ph (918) 542-2441
Fax (918) 542-2922
shawneetribes@shawnee-tribe.com

Turtle Mountain Band of Chippewa Indians of North Dakota
Kade Ferris, THPO
PO Box 900
Belcourt, ND 58316
Ph (701) 477-2604
Fax (701) 477-3593
kade@tribalresources.com

Merle St. Claire, Chairman
PO Box 900
Belcourt, ND 58316
Ph (701) 477-2600
Fax (701) 477-6836
Merle.stclaire@yahoo.com

Wyandotte Nation
Billy Friend, Chief
64700 East Highway 60
Wyandotte, OK 74370
Ph (918) 678-2297
Fax (918) 678-2944
bfriend@wyandotte-nation.org

Sherri Clemons, THPO
64700 East Highway 60
Wyandotte, OK 74370
Ph (918) 678-2297, ext. 244
Fax (918) 678-2944
sclemons@wyandotte-nation.org

Appendix B4

Relevant Historic Correspondence

MEMORANDUM OF AGREEMENT
Among the
Air National Guard Readiness Center,
190th Air Refueling Wing, Kansas Air National Guard
and
Kansas State Historic Preservation Officer
Pursuant to 36 CFR 800.6(c)
Regarding modifications and changes to
Building 679 Squad Operations
Forbes Field Air National Guard Base, Topeka, Kansas

WHEREAS, The Kansas Air National Guard (KS ANG) is a component of the Air National Guard Directorate within the National Guard Bureau, and Sec. 106 of the National Historic Preservation Act (16 USC Sec. 470F) (NHPA) and associated Federal regulations (36 CFR Part 800) apply to Air National Guard "undertakings" as defined in the NHPA and 36 CFR Sec. 800.16(y); and

WHEREAS, The Air National Guard Readiness Center (ANGRC) serves as Headquarters for the Federal entity initiating consultation under Sec.106 for this proposed action; and

WHEREAS, Building 679, located at Forbes Field Air National Guard Base, Topeka, KS, was constructed in 1958 during the Cold War for the Strategic Air Command as an Alert Mission Readiness Crew Building (31,044 square feet) is now used as an Operations Building; and

WHEREAS, The Area of Potential Effect (APE) is the current Building 679 footprint; as shown in attachment 3; and

WHEREAS, the 190th Air Refueling Wing (ARW) is stationed at Forbes Field Air National Guard Base and has sought to contact the public regarding this undertaking through its retirees' organization, the "Past & Active Kansas Coyotes" and having received no public comment; and

WHEREAS, The 190th ARW complies with NHPA requirements pursuant to Air Force Instruction 32-7065, *Cultural Resources Management;* and

WHEREAS, The 190th ARW has determined that there are no Federally-recognized Indian Tribes that attach traditional religious and cultural importance to the structure and landscape within the APE; and

WHEREAS, The 190th ARW intends to modify and alter Building 679, an undertaking that will constitute an adverse effect on the building, which the KS ANG has determined eligible for inclusion in the National Register of Historical

Places under criteria A and C and the 190th ARW has consulted with the Kansas State Historic Preservation Officer (KS SHPO) pursuant to 36 CFR Part 800, and

WHEREAS, In accordance with 36 CFR Sec. 800.6(a)(1), the 190th ARW notified the Advisory Council on Historic Preservation (Council) of this consultation on October 8, 2008 and on October 24, 2008, the Council responded in writing that it did not wish to participate in consultation pursuant to 36 CFR Sec. 800.6(a)(1)(iii).

NOW, THEREFORE, the ANGRC, KS SHPO and the 190th ARW agree that the undertaking shall be implemented in accordance with the following stipulations.

STIPULATIONS

The 190th ARW shall:

I. INTERPRETATION - Create a display case to house the original Building 679 architectural documents and photographs, as well as a history of the building developed from the "*Cultural Resources Survey and Evaluation Report for Kansas Air National Guard Properties at Forbes Field, Topeka, Kansas*" (ANG 2008). This display will be located in the building's entry corridor to facilitate access. The 190th ARW shall afford the KS SHPO an opportunity to comment on the conceptual drawings for the display prior to design completion. The KS SHPO will have 30 days from date of receipt to comment on the display design.

II. UNANTICIPATED DISCOVERIES - If historic properties are discovered or unanticipated effects on historic properties are found during the implementation of this undertaking, the 190th ARW shall consult with the KS SHPO pursuant to 36 CFR §800.4 to determine appropriate measures to treat the discovery.

ADMINISTRATIVE STIPULATIONS

I. The State of Kansas and the 190th ARW do not waive their sovereign immunity by entering into this Memorandum of Agreement (MOA), and each fully retains all immunities and defenses with respect to any action based on, or occurring as a result of, this MOA;

II. This MOA represents the entire and integrated agreement between the parties and supersedes all prior negotiations, representations and agreements, whether written or oral, regarding Section 106 review of the effects of the undertaking on Building 679 and the integrity of setting.

III. DISPUTE RESOLUTION – Should the KS SHPO object within thirty (30) days to any actions proposed or carried out pursuant to this agreement, the 190th ARW shall consult with the KS SHPO to resolve the objection.

A. At any time during the implementation of the measures stipulated in this agreement, should an objection to any such measure or its manner of implementation be raised by a member of the public or one of the parties to this agreement, the 190th ARW shall take the objection into account and consult as needed with the objecting party and if necessary, the KS SHPO.

B. If a dispute as described in III. A. above cannot be resolved, then the 190th ARW will notify the ANGRC and the Council, to resolve the objection. The 190th ARW and ANGRC shall request further comments from the Council pursuant to 36 CFR 800.6(b). Any Council comment provided in response to such a request shall be taken into account by the 190th ARW in accordance with 36 CFR Part 800 with reference only to the subject of the dispute. The 190th ARW's responsibility to carry out all actions under this agreement that are not the subject of the dispute will remain unchanged.

C. The 190th ARW shall consider non-signatory objections to the manner in which the terms of the agreement are implemented. If the objection cannot be resolved to the satisfaction of the 190th ARW and the objecting party, the 190th ARW shall request the signatories to provide their opinion on the matter. Prior to making a final decision on the matter, the 190th ARW shall take into account all the signatory opinions received within 15 days of the request.

C. Nothing in this Section shall be construed or interpreted as a waiver of any judicial remedy that would be available to any party to this MOA.

IV. AMENDMENTS - Any signatory to this MOA may request that the other signatories consider amending it if circumstances change over time and warrant revision of the stipulations. Amendments will be executed in the same manner as the original MOA and shall be governed by 36 CFR 800.6.

V. EXECUTION - Execution of this MOA by the 190th ARW and the KS SHPO through the submission of documentation and filing of a final copy of this MOA with the Council pursuant to 36 CFR Sec. 800.6(b)(1)(iv) and implementation of its terms is evidence that the Council has taken into account the effects of this undertaking on historic properties and has been afforded an opportunity to comment.

VI. ANTI-DEFICIENCY ACT COMPLIANCE- All requirements set forth in this MOA requiring expenditure of Federal funds are expressly subject to the availability of appropriations and the requirements of the Anti-Deficiency Act (31

USC Section 1341) No obligation undertaken by the 190th ARW under the terms of this MOA shall require or be interpreted to require a commitment to expend funds not appropriated for that purpose.

VII. TERMINATION - A. Any party to this agreement may terminate it by providing thirty (30) days written notice to the other parties, provided that the parties consult during the period prior to termination to seek agreement on amendments or other actions that will avoid termination.

B. In the event of termination, the 190th ARW, in consultation with the KS SHPO, will determine how to carry out the 190th ARW's responsibilities under Section 106 in a manner consistent with applicable provisions of 36 CFR Part 800.

VIII. SUNSET TERMS - This MOA will remain in effect for ten (10) years from the date of execution.

SIGNATORIES

Air National Guard Readiness Center

By: ______________________ Date: 11 AUG 09

CRAIG A. REZAC, Lt Col, USAF
Deputy Chief, Asset Management Division

Forbes Field Air National Guard Base

By: ______________________ Date: 28 AUG 09

KEITH I. LANG, Colonel, KSANG
Commander

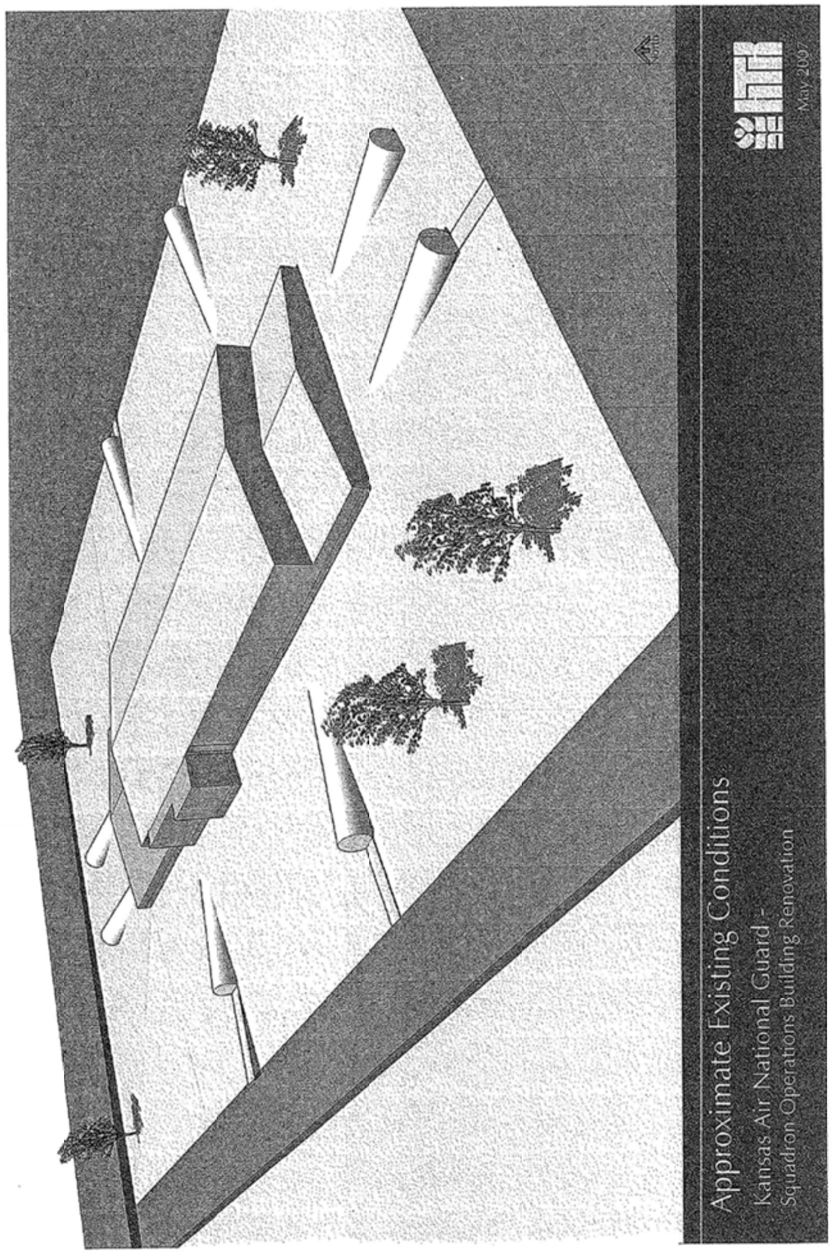
Kansas State Historic Preservation Officer

By: ______________________ Date: 8/4/09

Jennie Chinn, Executive Director
Kansas State Historic Society

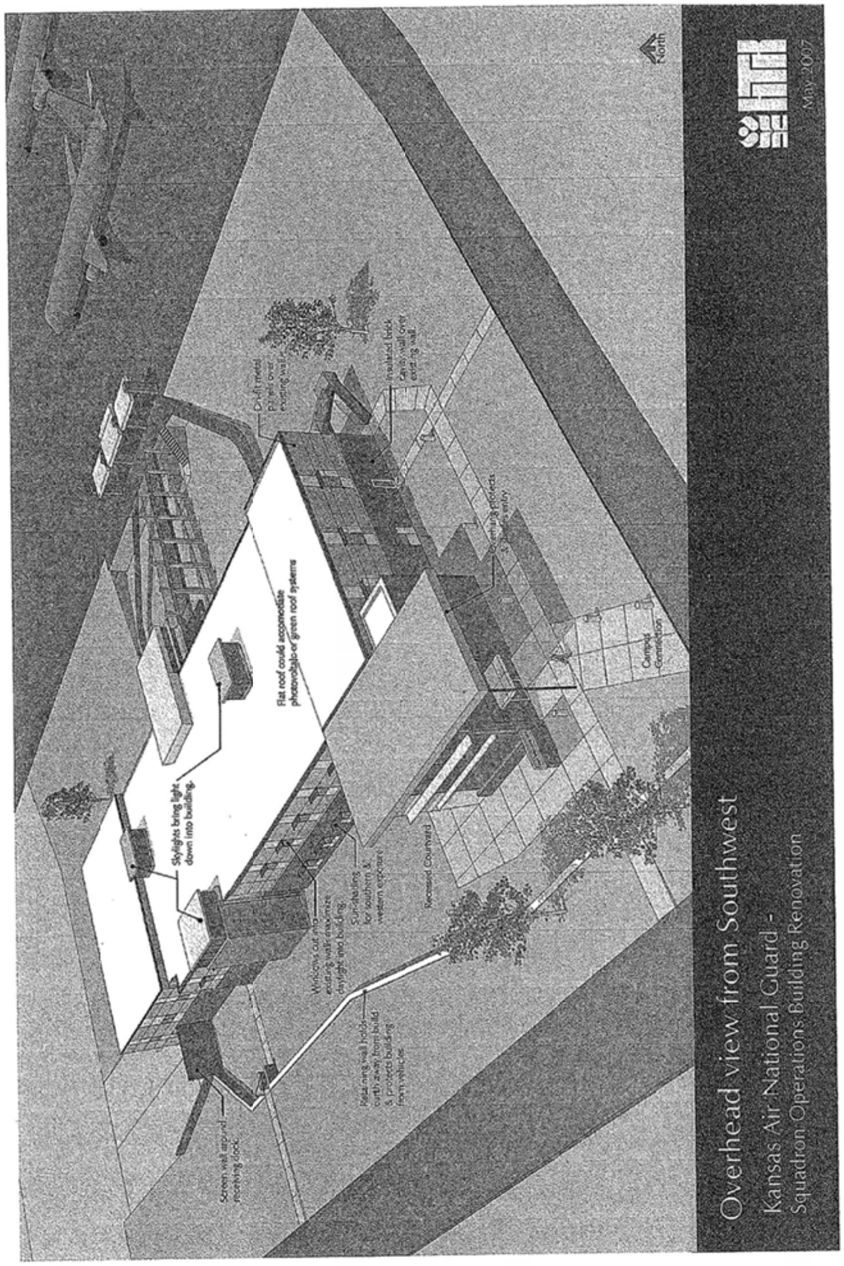
Attachments:

1. Drawing, Approximate Existing Conditions
2. Drawing, Overhead view from Southwest
3. Map, Forbes Field
4. Photo, Building 679, Forbes Field



Memorandum of Agreement: 190 ARW & KS SHPO

Attachment 1



Memorandum of Agreement: 190 ARW & KS SHPO

Attachment 2

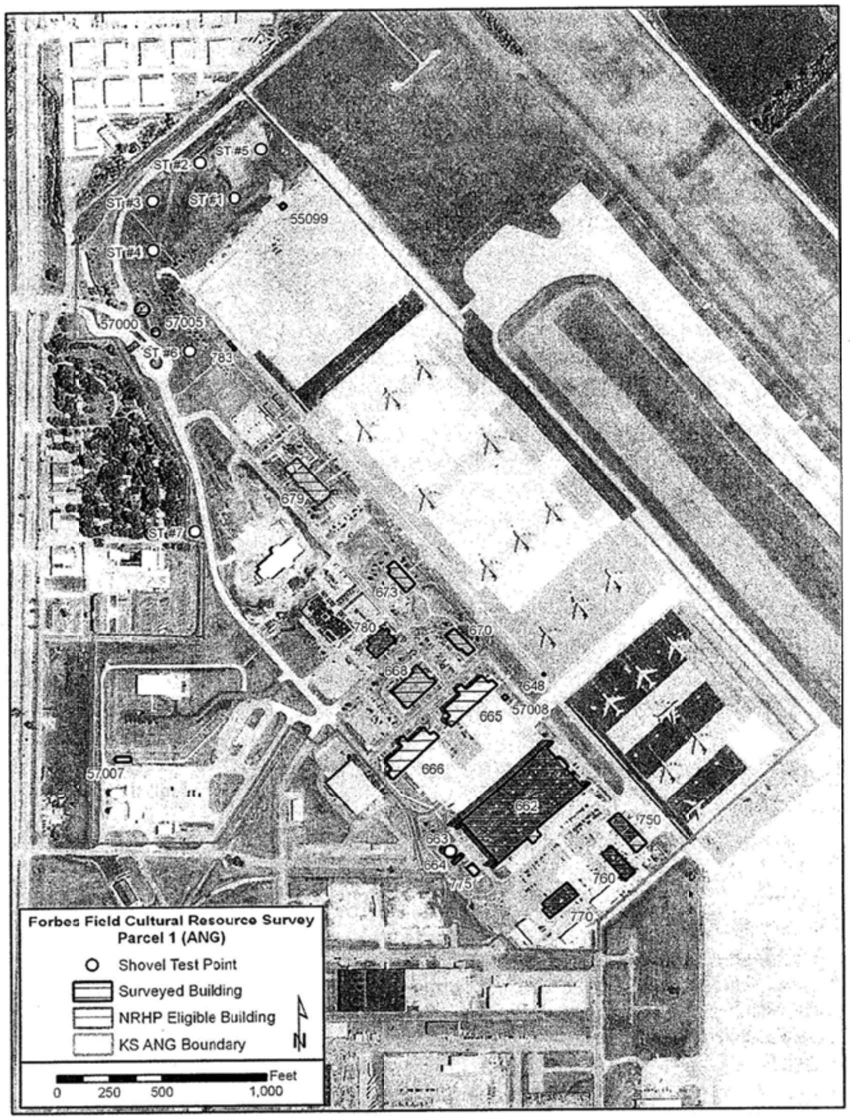


FIGURE 4-1. PARCEL 1 FORBES FIELD ANG BASE – CULTURAL RESOURCES SURVEY COVERAGE MAP

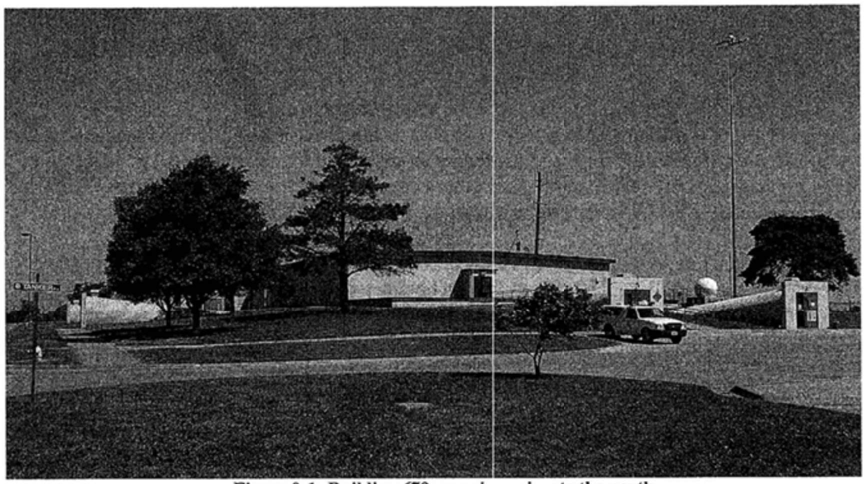


Figure 0-1: Building 679 overview, view to the north

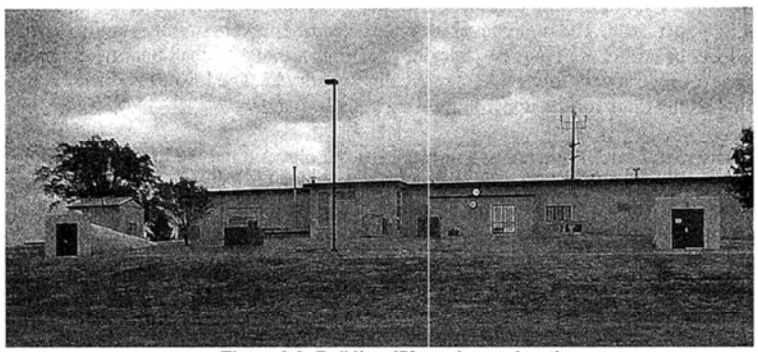


Figure 0-2: Building 679 southwest elevation.

Memorandum of Agreement: 190 ARW & KS SHPO

Attachment 4

KANSAS

KSR&C No. 08-05-040

Kansas State Historical Society
Patrick Zollner, *Director, Cultural Resources Division*

KATHLEEN SEBELIUS, GOVERNOR

June 18, 2008

Marjorie Nowick
Engineering-Environmental Management, Inc.
9563 South Kingston Court
Englewood, CO 80112

Re: Cultural Resources Survey of Forbes Field Air National Guard Base
Shawnee County

Dear Ms. Nowick:

In accordance with 36 CFR 800, the Kansas State Historic Preservation Office has reviewed a report entitled *Cultural Resources Survey and Evaluation Report for Kansas Air National Guard Properties at Forbes Field, Topeka, Kansas,* by Marjorie Nowick of Engineering-Environmental Management, Inc. We find the report to be acceptable and concur with its conclusion that Building 679 is potentially eligible for listing in the National Register of Historic Places. Our office also concurs with the determination that the other buildings surveyed are not eligible at this time.

We further conclude that the archeological investigations described in the report are sufficient and concur with the recommendation that no further survey or testing will be necessary.

Before receiving your survey and report, our office reviewed and cleared a proposed renovation project for Building 679 in a letter dated May 6, 2008. Upon receipt of your report with new information regarding the eligibility of Building 679, we contacted Mark Green at the Kansas Air National Guard and asked that the project be placed on hold. Since the proposed project will drastically alter Building 679, we have determined that it will constitute an adverse effect. At this point, we would like to consult with the Kansas Air National Guard to explore ways to avoid or minimize the adverse effect.

Thank you for giving us the opportunity to comment. Please submit any comments to Julie Weisgerber at 785-272-8681, ext 226.

6425 SW Sixth Avenue • Topeka, KS 66615-1099
Phone 785-272-8681 Ext. 217 • Fax 785-272-8682 • Email pzollner@kshs.org • TTY 785-272-8683
www.kshs.org

Sincerely,
Jennie Chinn
State Historic Preservation Officer

Patrick Zollner
Director, Cultural Resources Division
Deputy State Historic Preservation Officer

CC: Jan Gray Yagley, Cultural Resources Program Manager, Air National Guard
Matt Nowskowski, NEPA and Cultural Resources Technical Advisor
Major Mark Green, KSANG, Forbes Field Air National Guard Base

NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES

State of New Hampshire, Department of Cultural Resources
19 Pillsbury Street, Concord, NH 03301-3570
TDD Access: Relay NH 1-800-735-2964
www.nh.gov/nhdhr

603-271-3483
603-271-3558
FAX 603-271-3433
preservation@dcr.nh.gov

February 5, 2009

David A. Nylund, GS-12
NH Air National Guard
157 ARW/EM
302 Newmarket Street
Pease ANGB, NH 03803-0157

Dear Mr. Nylund,

Thank you for requesting a determination of National Register eligibility for the area listed below. As requested, the Division of Historical Resources' Determination of Eligibility Committee has reviewed the *DHR Area Form* prepared by you; based on the information available, the DOE Committee's evaluation of National Register eligibility is:

TOWN/CITY	PROPERTY	DETERMINATION
Newington	Pease International Tradeport, NWN-PAFB	Not Eligible

A copy of the DHR evaluation form is attached for your use. The inventory data and the evaluation will also be added to the statewide survey database for historic properties in New Hampshire.

Please call Mary Kate Ryan (271-6435) if you have questions.

Sincerely,

Christina St. Louis

Christina St.Louis
Program Specialist

Enclosure

cc: Elizabeth Muzzey, Director / State Historic Preservation Officer
William Rutter, SAIC, Inc.

NH Division of Historical Resources
Determination of Eligibility (DOE)

Date received: 12/24/2008 | Inventory #: ~~N/A~~ NWN- PAFB

Date of group review: 1/14/2009 | Area: Pease AFB

DHR staff: Nadine | Town/City: Newington

Property name: Pease Air Force Base | County: Rockingham

Address: Pease International Tradeport Pease Blvd./Newington Road., Aboretum Dr.

Reviewed for: [X]R&C [ ]PTI [ ]NR [ ]SR [ ]Survey [ ]Other
NH Air National Guard

Individual Properties

NR	SR
[ ]	[ ]Eligible
[ ]	[ ]Eligible, also in district
[ ]	[ ]Eligible, in district
[X]	[X]Not eligible
[ ]	[ ]More information needed
[ ]	[ ]Not evaluated for individual eligibility

Districts

NR	SR
[ ]	[ ]Eligible
[X]	[X]Not eligible
[ ]	[ ]More information needed
[ ]	[ ]Not evaluated @ district

Integrity: [X]Location [ ]Design [ ]Setting [ ]Materials
[ ]Workmanship [ ]Feeling [ ]Association

Criteria: [ ]A. Event [ ]B. Person [ ]C. Architecture/Engineering
[ ]D. Archaeology [ ]E. Exception

Level: [ ]Local [ ]State [ ]National

STATEMENT OF SIGNIFICANCE:
☐ **IF THIS PROPERTY IS REVIEWED IN THE FUTURE, ADDITIONAL DOCUMENTATION WILL BE NEEDED.**

This area form evaluates 218 acres of a former air base originally containing 4,300+ acres, consisting of functional military buildings and structures clustering in the northeast quadrant of the Pease International Tradeport, a commercial park redeveloped across most of the former air force base. Field reconnaissance, archival and literature research, photography, and assessment of the Pease building assemblage dating to the Cold War period (prior to 1990) resulted in the determination that none of the structures meet the criteria for listing in the National Register of Historic Places either individually or as a historic district. The area is characterized by its incomplete, scattered and incohesive character of surviving buildings and structures, many of which have been heavily altered or removed.

☑ **ENTERED INTO DATABASE**
ACREAGE: 218
PERIOD OF SIGNIFICANCE: N/A
AREA OF SIGNIFICANCE: N/A
BOUNDARY:
SURVEYOR: William Rutter, SAIC, Inc.

FOLLOW-UP: Notify agency and consultant. Thank you for the high-quality submittal following NHDHR guidelines.

Final DOE approved by: Mary Kate Ryan

NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES

State of New Hampshire, Department of Cultural Resources
19 Pillsbury Street, Concord, NH 03301-3570
TDD Access: Relay NH 1-800-735-2964
www.nh.gov/nhdhr

603-271-3483
603-271-3558
FAX 603-271-3433
preservation@dcr.nh.gov

February 19, 2009

David Nylund
Environmental Manager
NHANG
157 ARW/EM
302 Newmarket Street
Pease ANGB, NH 03803-0157

Re: Review of Draft Final Cultural Resources Survey (CRS)
Historic District Area Form Pease AFB
Pease ANGB, NH

Dear Mr. Nylund:

In accordance with Section 106 of the National Historic Preservation Act (16 U.S. C. 470), and with federal Advisory Council on Historic Preservation regulations, *Protection of Historic Properties* (36 CFR Part 800), the New Hampshire Division of Historical Resources (DHR)/State Historic Preservation Office has reviewed the information submitted on December 3, 2008 and December 24, 2008 in regards to the above-referenced property. A Cultural Resources Survey and a Historic District Area Form for Pease AFB were submitted. The area form evaluated 218 acres of the former air base originally containing 4,300+ acres, consisting of functional military buildings and structures clustering in the northeast quadrant of the Pease International Tradeport, a commercial park redeveloped across most of the former air force base. The DHR concurred that none of the structures meet the criteria for listing in the National Register of Historic Places either individually or as a historic district. With respect to archaeological resources, DHR staff concurs with the findings in the Cultural Resources Survey.

Thank you for the opportunity to comment.

Sincerely,

EH Muzzey

Elizabeth H. Muzzey
Director/State Historic Preservation Officer

Commonwealth of Pennsylvania
Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Commonwealth Keystone Building, 2nd Floor
400 North Street
Harrisburg, PA 17120-0093
www.phmc.state.pa.us

April 22, 2011

John Tower, LTC, PA ANG
Pennsylvania Air National Guard
Headquarters 171st Air Refueling Wing
Pittsburgh International Airport
Coraopolis, PA 15108

Re: ER 85-1695-003-OOO
DOD: Renovation of Maintenance Hangers, Buildings 301 and 302
171st Air Refueling Wing, Pennsylvania Air National Guard,
Pittsburgh International Airport, Findlay Township, Allegheny County

Dear Ltc. Tower:

The Bureau for Historic Preservation (the State Historic Preservation Office) has reviewed the above named project in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended in 1980 and 1992, and the regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation as revised in 1999 and 2004. These regulations require consideration of the project's potential effect upon both historic and archaeological resources.

We concur with the findings of the agency that the following properties are not eligible for listing in the National Register of Historic Places due to a loss of integrity.

Hangers 301 and 302, Pittsburgh International Airport
Findlay Township, Allegheny County

If you need further information in this matter please consult Susan Zacher at (717) 783-9920.

Sincerely,

Andrea L. MacDonald, Chief
Division of Preservation Services

AM/smz

Commonwealth of Pennsylvania
Pennsylvania Historical and Museum Commission
Bureau for Historic Preservation
Commonwealth Keystone Building, 2nd Floor
400 North Street
Harrisburg, PA 17120-0093
www.phmc.state.pa.us

13 December 2011

Teresa Rudolph
TEC, Inc.
250 Bobwhite Court, Suite 200
Boise, ID 83706

TO [illegible] REVIEW USE
BH[illegible] NUMBER

Re: ER# 1985-1695-003-RRR
DOD: Draft Final Cultural Resource Survey,
171st Air Refueling Wing, Findlay
Township, Allegheny County

Dear Ms. Rudolph:

The Bureau for Historic Preservation (the State Historic Preservation Office) has reviewed the above named project in accordance with Section 106 of the National Historic Preservation Act of 1966, as amended in 1980 and 1992, and the regulations (36 CFR Part 800) of the Advisory Council on Historic Preservation as revised in 1999 and 2004. These regulations require consideration of the project's potential effect upon both historic and archaeological resources.

Archaeology

This report meets our standards and specifications as outlined in *Guidelines for Archaeological Investigations in Pennsylvania* (BHP 2008) and the Secretary of the Interior's Guidelines for Archaeological Documentation. It is our opinion that the portion of the Colfer/Rieck Farm Site (36AL0626) within the area-of-potential-effect (APE) would not contribute to the eligibility of the overall resource and no further archaeological work is necessary for this project. Should the scope of the project change and ground disturbance outside of the current facility fencing be undertaken, additional archaeological investigation may be necessary.

Please send three copies of the final report (one unbound and all with original photographs) for our files and distribution to the various repositories.

Historic Structures

Thank you for including a Historic Resource Survey form for the facility in your archaeological report. We are unable to process this bound copy cannot be forwarded for National Register review. Please submit an unbound copy of the form, maps and any photos showing the buildings.

Page 2
12/13/2011
Ms. Rudolph
ER 1985-1695-003-RRR

If you need further information regarding archaeological resources, please contact Kira Heinrich at (717) 705-0700. If you need further information concerning historic structures, please contact Susan Zacher at (717) 783-9920.

Sincerely,

Kira Heinrich (for)

Douglas C. McLearen, Chief
Division of Archaeology &
Protection

DCM/kmh

OHIO HISTORY

August 23, 2007

Matt Nowakowski
National Guard Bureau NGB/A7CVN
Conaway Hall – Air National Guard Readiness Center
3500 Fetchet Avenue
Andrews AFB, MD 20762

Re: 121 ARW Ohio ANG, Rickenbacker IAP, Draft Final Cultural Resources Survey
Hamilton Township, Franklin County, Ohio

Dear Mr. Nowakowski,

This is in response to correspondence from Roger A. Jones, Ohio Air National Guard, dated May 16, 2007 (received May 18) regarding cultural resource management program development at Rickenbacker IAP. The comments of the Ohio Historic Preservation Office (OHPO) are submitted in accordance with provisions of the National Historic Preservation Act of 1966, as amended (16 U.S.C. 470).

The report documents archaeological and architectural surveys of the portion of Rickenbacker that is occupied by the 121st Air Refueling Wing, Ohio Air National Guard. We have further comments on this, below. We agree that the surveys fulfill National Guard Bureau responsibilities to identify historic properties in this portion of Rickenbacker. We also agree that the buildings and structures included in and evaluated as part of this survey within this portion are not part of a larger historic district. The archaeological survey included background review, pedestrian walk-over, and shovel testing. The results of the archaeological survey include the identification of 2 archaeological sites, both isolated finds. We concur that sites 33-FR-2652 and 33-FR-2653 do not meet National Register eligibility criteria and do not warrant further investigations. We agree that no further archaeological survey is necessary for this portion of Rickenbacker. We recommend that the Cultural Resources Management Plan should provide for contingencies if archaeological deposits are identified in the future. The architectural survey included systematic recording of 18 buildings and structures within the 121st AFW portion of Rickenbacker. Recordation and evaluation was based on the context developed for this survey. We agree that the two maintenance hangars, Building 885 and Building 888 should be regarded as eligible for inclusion in the National Register of Historic Places. These two buildings are recorded as Ohio Historic Inventory FRA-9632-25 and FRA-9634-25. We also agree that the following buildings and structures do not meet National Register eligibility criteria: 670, 846, 849, 872, 873, 875, 879, 880, 882, 887, 911, 913, and 916. (See attached list that provides corresponding Ohio Historic Inventory numbers for building numbers.)

OHIO HISTORICAL SOCIETY
Ohio Historic Preservation Office
567 East Hudson Street, Columbus, Ohio 43211-1030 ph: 614.298.2000 fx: 614.298.2037
www.ohiohistory.org

Mr. Matt Nowakowski
August 23, 2007
Page 2

The Pilots' Memorial Monuments site (described in the draft report as Building 805) is a modern commemorative memorial that includes static, and sometimes temporary, displays. These kinds of cultural resources are difficult to deal with under the National Historic Preservation Act. This memorial is important. We recommend that this memorial site should be specifically included and given separate consideration in the Cultural Resources Management Plan.

As shown in Figure 5-1 on Page 5-3, the 121st Air Refueling Wing (ARW) occupies a portion of the Rickenbacker International Airport (Rickenbacker IAP). Rickenbacker IAP is a relatively recent redesignation and many folks still commonly refer to this as Rickenbacker Air Force Base. At several places the draft report appears to use almost interchangeably the terms 121st ARW and Rickenbacker and we are concerned that this can cause confusion. For example, see the opening sentence on Page 5-1. There have been several surveys that included recordation of architectural properties within or adjacent to Rickenbacker, but this current survey only included 18 buildings and structures within the 121st ARW portion of Rickenbacker. Because this interchanging use of Rickenbacker and 121st ARW occurs in several places we recommend some editing to make sure that the scope of the present survey is clearly distinguished. As noted above, we agree that the scope of the current archaeological and architectural survey is appropriate and fulfills National Guard Bureau responsibilities to complete the inventory of cultural resources within the 121st ARW, Ohio Air Force National Guard, portion of Rickenbacker IAP.

The report is readable and relatively free of typographical errors. In order to improve a little bit the readability and to provide some minor clarification, we suggest a number of editorial changes to assist in final editing. As previously noted, it is important to clarify the scope of the survey versus the extent of the entire airport. And we have also noted that Building 805 is a site. The township, Hamilton, should be added to the title. In the Abstract, in the third sentence of the second paragraph, we suggest adding that the assessment is of the 18 buildings of the 121st ARW building assemblage. As currently written it appears that there were 121 buildings assessed. On Page 1-1, as noted in copy, clarification is needed for the "…104 FW " reference. And, beginning on Page 1-1 and throughout, it would be helpful to make sure that 121 ARW is 121st ARW. You have noted the change on Page 2-7. On Page 2-15, the end of the first paragraph (lines 10-14) is confusing. We recommend shortening this section considerably. Your change on Page 2-20 is noted. On Page 2-24, line 7, change undermine to another word – perhaps dispel. On Page 3-1 there is a reference to massive ground disturbance throughout virtually all of Rickenbacker. We are not certain that this is true. It is certainly true for the 121st ARW portion. It still appears to us that there are strips of land along the southeast corner of Rickenbacker where archaeological survey has not been conducted, or even considered. On Page 5-13, Figure 5-9, it appears that the photograph shows the southwest and southeast elevations. On Page 5-19, Building 882 is a structure. On Page 5-23, Figure 5-18, photograph appears to show the northwest and southwest elevations. On Page 5-23, bottom, line 17, …its appearance and plan have (not has) been… On

Mr. Matt Nowakowski
August 23, 2007
Page 3

Page 5-24, Figure 5-19, photograph appears to show northeast and southeast elevations. On Page 5-34, the light poles (Building 81004) are structures. On Page 6-1, line 13, the guidelines have been consulted (maybe some other word? "Employed" doesn't sound right to our ears.) Your change on Page 7-3 is noted. Figure 7-1 doesn't include options for seeking public input, it should.

Please make sure that original inventory forms have been submitted to the Ohio Historic Preservation Office. We don't have an inventory form for Building 886 (see in text and appendix). From the description we don't need a form for Building 886, but a form for Building 887 would be helpful (see attached). From the description (a small, plain, electrical utility shed) we don't need a photograph of Building 886.

In addition to providing a report of a cultural resources management survey, the report also offers a good deal of information on maintaining cultural resources as an integral part of the environmental review process within the 121st ARW, Ohio Air Force National Guard. And, it is our understanding that this part of the report will provide the foundation for developing an agreement with the Ohio Historic Preservation Office that establishes authority for the Ohio Air Force National Guard to complete, as stipulated in the agreement, Section 106 reviews without requiring separate OHPO concurrence. Provided that we follow the provisions of the National Historic Preservation Act, we believe that it is appropriate and beneficial for agencies to assume responsibility for managing historic properties and for directing Section 106 reviews. We encourage the National Guard Bureau and the Ohio Air Force National Guard to continue the development of a programmatic agreement towards these ends.

One of the reasons that we stress the importance of completing Ohio Historic Inventory forms for historic properties is that these inventory forms provide a vitally important foundation that will support future decisions. Reaching decisions on maintenance will be facilitated by careful attention to detail in these beginning steps. We are not providing here final comments on the Ohio Historic Inventory forms or on the descriptions of Buildings 885 and 888. Additional comments on inventory forms will be provided in the near future under separate cover.

In many ways the report succeeds in laying out some broad preservation objectives, but we believe that much more work is needed to complete a Cultural Resources Management Plan. The additional work needs to emphasize specificity. For example, the report indicates that an annual inspection of historic properties is desirable, but it doesn't tell us who is to conduct the inspection,

Mr. Matt Nowakowski
August 23, 2007
Page 4

what information is to be recorded, and how the results of the inspection will be processed and disseminated. Does some peeling of paint on one of the cantilevered door panels on one of the hangars indicate a problem that requires action? In sum, there are too many general statements from the Secretary of the Interior's Standards (36 CFR 67) and not enough actions statements that tell us how these will be applied at Rickenbacker.

Any questions concerning this matter should be addressed to Lisa Adkins or David Snyder at (614) 298-2000, between the hours of 8 am. to 5 pm. Thank you for your cooperation.

Sincerely,

David Snyder

David Snyder, Ph.D., Archaeology Reviews Manager
Resource Protection and Review

DMS/ds (OHPO Serial Number 1013050)

Attachment

xc: Roger A. Jones, Environmental Manager, Ohio Air National Guard, HQ 121st ARW, 7370 Minuteman Way, Columbus, OH 43217-5875
Lorraine Gross, SAIC, 405 Eighth Street, Suite 301, Boise, ID 83702

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Appendix B5

Draft EIS Distribution List

Forbes ANGS

Joe Summerlin, NEPA Reviewer, U.S. Environmental Protection Agency, Region 7, 11201 Renner Blvd, Lenexa, KS 66219
U.S. Fish and Wildlife Service, Kansas Ecological Services Field Office, 2609 Anderson Ave, Manhattan, KS 66502-2801
Federal Aviation Administration, Central Region, 901 Locust St, Kansas City, MO 64106-2641
John Mitchell, Kansas Department of Health and Environment, Division of Environment, 1000 SW Jackson, Ste 400, Topeka, KS 66612-1367
Kansas Department of Wildlife and Parks, Region 2, 300 SW Wanamaker Rd, Topeka, KS 66606
Jennie Chinn, State Historic Preservation Officer, Kansas State Historical Society, Cultural Resources Division, 6425 SW 6th Ave, Topeka, KS 66615-1099
Director of Aviation, Kansas Department of Transportation, Dwight D. Eisenhower State Office Building, 700 SW Harrison, Topeka, KS 66603-3754
Shelly Buhler, Chair, Shawnee County Commissioner, District 1, 200 SE 7th St, Topeka, KS 66603
Shawnee County Planning Department, 1515 NW Saline St, Ste 102, Topeka, KS 66618
The Honorable Bill Bunten, Mayor of Topeka, 215 SE 7th, Room 352, Topeka, KS 66603-3914
Larry Wolgast, Councilperson, Topeka City Council District #5, 1512 SW 30th St, Topeka, KS 66611
City of Topeka Planning, 620 SE Madison, Topeka, KS 66607
Eric Johnson, Metropolitan Topeka Airport Authority, Forbes Field, Building 620, Topeka, KS 66619
Steve Ortiz, Council Chair, Prairie Band Potawatomi Tribe, 16281 Q Rd, Mayetta, KS 66509
Rick Campbell, Director, Environmental Department, Sac and Fox Nation of Missouri, 305 N Main St, Reserve, KS 66434
The Honorable Jerry Moran, U.S. Senate, 354 Russell Senate Office Bldg, Washington, DC 20510
The Honorable Pat Roberts, U.S. Senate, 109 Hart Senate Office Bldg, Washington, DC 20510
The Honorable Lynn Jenkins, House of Representatives, 1027 Longworth HOB, Washington, DC 20515
The Honorable Vicki Schmidt, Kansas Senate, 5906 SW 43rd Ct, Topeka, KS 66610-1632
The Honorable Lana Gordon, Kansas House of Representatives, 5820 SW 27th St, Topeka, KS 66614
The Honorable Sam Brownback, Office of the Governor, 300 SW 10th Ave, Ste 241S, Topeka, KS 66612-1590
Kelli Mosteller, THPO, Citizen Potawatomi Nation, 1601 S Gordon Cooper Dr, Shawnee, OK 74801
John Barrett, Chairman, Citizen Potawatomi Nation, 1601 S Gordon Cooper Dr, Shawnee, OK 74801
Tamara Francis, THPO, Delaware Nation, 31064 US Highway 281, Bldg. 100, Anadarko, OK 73005
Kerry Holton, President, Delaware Nation, PO Box 825, Anadarko, OK 73005
Guy Munroe, Chairman, Kaw Nation, Drawer 50, Kaw City, OK 74641
Andrea Hunter, THPO, Osage Nation of Oklahoma, 627 Grandview, Pawhuska, OK 74056
John Redeagle, Principal Chief, Osage Nation of Oklahoma, PO Box 779, 627 Grandview, Pawhuska, OK 74056
George Blanchard, Absentee Shawnee Tribe of Oklahoma, 2025 S Gordon Cooper Dr, Shawnee, OK 74801
Henryetta Ellis, THPO, Absentee Shawnee Tribe of Oklahoma, 2025 S Gordon Cooper Dr, Shawnee, OK 74801
Glenna Wallace, Chief, Eastern Shawnee Tribe of Oklahoma, 12755 S 705 Rd, Wayandotte, OK 74370
Leslie Standing, President, Wichita and Affiliated Tribes, PO Box 729, Anadarko, OK 73005
John Armbrust, Governor's Military Council, 501 Poyntz Ave, Manhattan, KS 66502
Rick Taylor, Topeka, KS 66614

JB MDL

Eric Davis, Supervisor, U.S. Fish and Wildlife Service, New Jersey Ecological Services Field Office, 927 N Main St, Bldg D, Pleasantville, NJ 08232
Environmental Review Coordinator, U.S. Environmental Protection Agency, Region 2, 290 Broadway, New York, NY 10007-1866
Richard Shaw, State Soil Scientist, Natural Resources Conservation Service, New Jersey State Office, 220 Davidson Ave, 4th Floor, Somerset, NJ 08873
Paul Phifer, Ph.D., Assistant Regional Director, Ecological Services, U.S. Fish and Wildlife Service, Region 5, 300 Westgate Center Dr, Hadley, MA 01035-9589
Ruth W. Foster, PhD, Supervisor, New Jersey Department of Environmental Protection, Office of Permit Coordination and Environmental Review, 401 E State St, 7th Floor, PO Box 420, Trenton, NJ 08625-0420

Daniel Saunders, Administrator and Deputy State Historic Preservation Officer, New Jersey Department of Environmental Protection, Historic Preservation Office, PO Box 420, Trenton, NJ 08625-420

New Jersey Division of Fish and Wildlife, Endangered and Nongame Species Program, Department of Environmental Protection, PO Box 420, Trenton, NJ 08625-420

Ernie Deman, Supervising Environmental Specialist, New Jersey Pinelands Commission, 15 Springfield Rd, New Lisbon, NJ 08064

Coordinator, Regional Planning, Burlington County, 50 Rancocas Rd, Mount Holly, NJ 08060

Mary Pat Robbie, Director, Resource Conservation, Burlington County, PO Box 6000, Mount Holly, NJ 08060

Mark Gould, Chairperson, Nanticoke-Lenni-Lenape Indians of New Jersey, 18 E Commerce St, PO Box 544, Bridgeton, NJ 08302

Dwaine Perry, Chief, Ramapough Mountain Indians, 189 Stag Hill Rd, Mahwah, NJ 07430

Joanne Bundy Hawkins, Powhattan-Renape Nation, Rankokus Indian Reservation, PO Box 225, Rancocas, NJ 08073

The Honorable Thomas Harper, Mayor of Wrightstown, 21 Saylors Pond Rd, Wrightstown, NJ 08562

The Honorable Ronald Francioli, Mayor of New Hanover Township, 1000 Route 10, PO Box 250, Whippany, NJ 07981

The Honorable Jim Durr, Mayor of North Hanover Township, 41 Schoolhouse Rd, Jacobstown, NJ 08562

The Honorable David Patriarca, Mayor of Pemberton Township, 500 Pemberton-Browns Mills Rd, Pemberton, NJ 08068-1539

The Honorable Denis McDaniel, Mayor of Springfield Township, PO Box 119, Jobstown, NJ 08041

The Honorable Michael Reina, Mayor of Jackson Township, 95 W Veterans Hwy, Jackson, NJ 08527

The Honorable Mike Fressola, Mayor of Manchester Township, 1 Colonial Dr, Manchester, NJ 08759

The Honorable David Leutwyler, Mayor of Plumsted Township, 121 Evergreen Rd, New Egypt, NJ 08533

The Honorable Jeff Chiesa, U.S. Senate, 141 Hart Senate Office Bldg, Washington, DC 20510

The Honorable Robert Menendez, U.S. Senate, 528 Hart Senate Office Bldg, Washington, DC 20510

The Honorable Jon Runyun, House of Representatives, 1239 Longworth HOB, Washington, DC 20515

The Honorable Chris Smith, House of Representatives, 2373 Rayburn House Office Building, Washington, DC 20515

The Honorable Chris Christie, Office of the Governor, PO Box 001, Trenton, NJ 08625

The Honorable Samuel Thompson, New Jersey Senate, 2501 Highway 516, Ste 101, Old Bridge, NJ 08857

The Honorable Robert Clifton, New Jersey Assembly, 516 Route 33 West, Bldg 2, Ste 2, Millstone, NJ 08535

The Honorable Ronald Dancer, New Jersey Assembly, 405 Rt 539, Cream Ridge, NJ 08514

Megan Branatti, New Jersey Department of Environmental Protection, 401 E State St, Trenton, NJ 08625

Ian Marquez, U.S. Marine Corps, 15 Brynmore Rd, New Egypt, NJ 08533

Mark Villinger, Ocean County Planning, 129 Hooper Ave, Toms River, NJ 08753

Emil Kaunitz, Def Enhancement Coalition, 1451 Rt 37 W, Toms River, NJ 08755

Tamara Francis, THPO, Delaware Nation, 31064 US Highway 281, Bldg 100, Anadarko, OK 73005

Kerry Holton, President, Delaware Nation, PO Box 825, Anadarko, OK 73005

Brice Obermeyer, THPO, Delaware Tribe of Indians, Department of Sociology and Anthropology, Emporia State University, Roosevelt Hall, Rm. 212, 1200 Commercial St., Emporia, KS 66801

Paula Pechonick, Chief, Delaware Tribe of Indians, 170 NE Barbara St, Bartlesville, OK 74006

Chester Brooks, Trust Board Chairman, Delaware Tribe of Indians, 170 NE Barbara St, Bartlesville, OK 74006

Catherine Costa, Chairwoman, Burlington County Soil Conservation District, 1971 Jacksonville-Jobstown Road, Columbus, NJ 08022

Pease ANGS

U.S. Environmental Protection Agency, Region 1, 5 Post Office Square, Ste 100, Boston, MA 02109-3912

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Appendix C

Background Information for the Noise Analysis

APPENDIX C BACKGROUND INFORMATION FOR THE NOISE ANALYSIS

1. Basics of Sound

Noise is unwanted sound. Sound is all around us; sound becomes noise when it interferes with normal activities, such as sleep or conversation.

Sound is a physical phenomenon consisting of minute vibrations that travel through a medium, such as air, and are sensed by the human ear. Whether that sound is interpreted as pleasant (e.g., music) or unpleasant (e.g., jackhammers) depends largely on the listener's current activity, past experience, and attitude toward the source of that sound.

The measurement and human perception of sound involves three basic physical characteristics: intensity, frequency, and duration. First, intensity is a measure of the acoustic energy of the sound vibrations and is expressed in terms of sound pressure. The greater the sound pressure, the more energy carried by the sound and the louder the perception of that sound. The second important physical characteristic of sound is frequency, which is the number of times per second the air vibrates or oscillates. Low-frequency sounds are characterized as rumbles or roars, while high-frequency sounds are typified by sirens or screeches. The third important characteristic of sound is duration or the length of time the sound can be detected.

The loudest sounds that can be detected comfortably by the human ear have intensities that are a trillion times higher than those of sounds that can barely be detected. Because of this vast range, using a linear scale to represent the intensity of sound becomes very unwieldy. As a result, a logarithmic unit known as the decibel (abbreviated dB) is used to represent the intensity of a sound. Such a representation is called a sound level. A sound level of 0 dB is approximately the threshold of human hearing and is barely audible under extremely quiet listening conditions. Normal speech has a sound level of approximately 60 dB; sound levels above 120 dB begin to be felt inside the human ear as discomfort. Sound levels between 130 to 140 dB are felt as pain (Berglund and Lindvall 1995).

Because of the logarithmic nature of the decibel unit, sound levels cannot be arithmetically added or subtracted and are somewhat cumbersome to handle mathematically. However, some simple rules are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. For example:

$$60 \text{ dB} + 60 \text{ dB} = 63 \text{ dB, and}$$

80 dB + 80 dB = 83 dB.

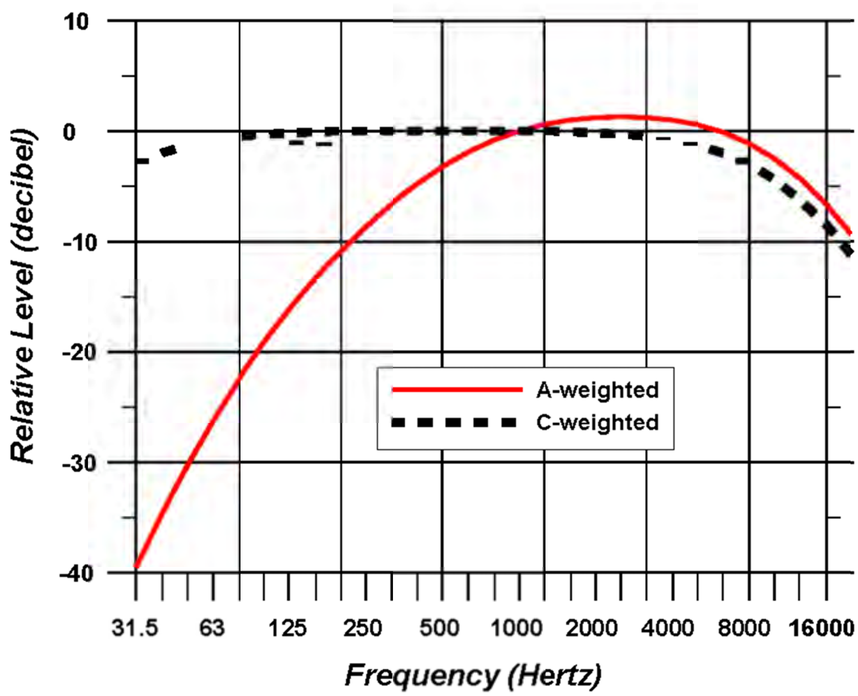
Second, the total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

60.0 dB + 70.0 dB = 70.4 dB.

Because the addition of sound levels is different than that of ordinary numbers, such addition is often referred to as "decibel addition" or "energy addition." The latter term arises from the fact that what we are really doing when we add decibel values is first converting each decibel value to its corresponding acoustic energy, then adding the energies using the normal rules of addition, and finally converting the total energy back to its decibel equivalent.

The minimum change in the sound level of individual events that an average human ear can detect is about 3 dB. On average, a person perceives a change in sound level of about 10 dB as a doubling (or halving) of the sound's loudness, and this relation holds true for loud and quiet sounds. A decrease in sound level of 10 dB actually represents a 90 percent decrease in sound intensity but only a 50 percent decrease in perceived loudness because of the nonlinear response of the human ear (similar to most human senses).

Sound frequency is measured in terms of cycles per second (cps), or hertz (Hz), which is the standard unit for cps. The normal human ear can detect sounds that range in frequency from about 20 Hz to about 15,000 Hz. All sounds in this wide range of frequencies, however, are not heard equally by the human ear, which is most sensitive to frequencies in the 1,000 to 4,000 Hz range. Weighting curves have been developed to correspond to the sensitivity and perception of different types of sound. A-weighting and C-weighting are the two most common weightings. A-weighting accounts for frequency dependence by adjusting the very high and very low frequencies (below approximately 500 Hz and above approximately 10,000 Hz) to approximate the human ear's lower sensitivities to those frequencies. C-weighting is nearly flat throughout the range of audible frequencies, hardly de-emphasizing the low frequency sound while approximating the human ear's sensitivity to higher intensity sounds. The two curves shown in Figure C-1 are also the most adequate to quantify environmental noises.



Source: ANSI S1.4A -1985 "Specification of Sound Level Meters"

Figure C-1. Frequency Response Characteristics of A- and C-Weighting Networks

A-weighted Sound Level

Sound levels that are measured using A-weighting, called A-weighted sound levels, are often denoted by the unit dBA or dB(A) rather than dB. When the use of A-weighting is understood, the adjective "A-weighted" is often omitted and the measurements are expressed as dB. In this report (as in most environmental impact documents), dB units refer to A-weighted sound levels.

Noise potentially becomes an issue when its intensity exceeds the ambient or background sound pressures. Ambient background noise in metropolitan, urbanized areas typically varies from 60 to 70 dB and can be as high as 80 dB or greater; quiet suburban neighborhoods experience ambient noise levels of approximately 45-50 dB (U.S. Environmental Protection Agency [USEPA] 1978).

Figure C-2 is a chart of A-weighted sound levels from typical sounds. Some noise sources (air conditioner, vacuum cleaner) are continuous sounds which levels are constant for some time. Some (automobile, heavy truck) are the maximum sound during a vehicle pass-by. Some (urban daytime, urban nighttime) are averages over extended periods. A variety of noise metrics have been developed to describe noise over different time periods, as discussed below.

Aircraft noise consists of two major types of sound events: aircraft takeoffs and landings, and engine maintenance operations. The former can be described as intermittent sounds and the latter as continuous. Noise levels from flight operations exceeding background noise typically occur beneath main approach and departure corridors, in local air traffic patterns around the airfield, and in areas immediately adjacent to parking ramps and aircraft staging areas. As aircraft in flight gain altitude, their noise contribution drops to lower levels, often becoming indistinguishable from the background.

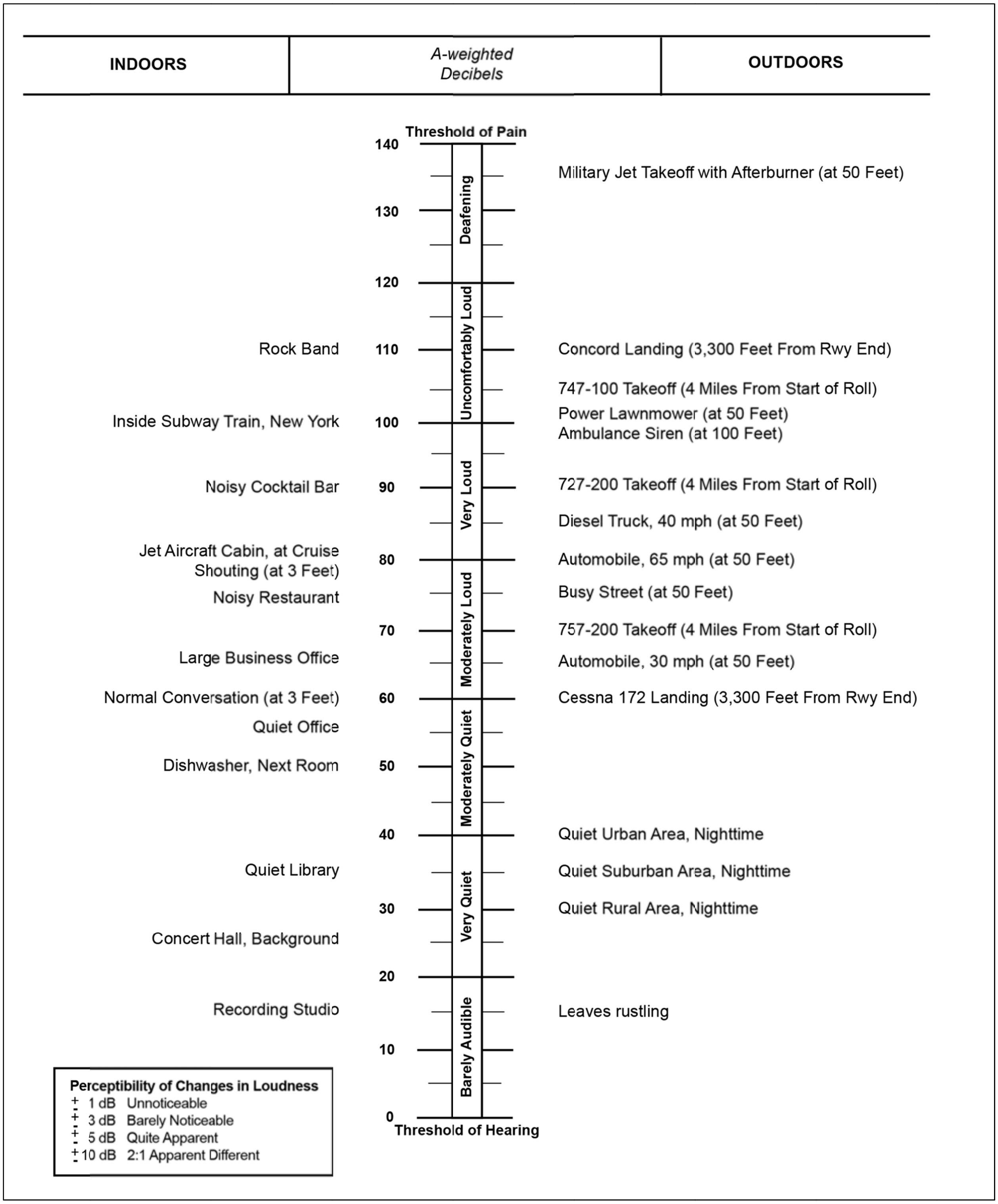
1.1 Noise Metrics

In general, a metric is a statistic for measuring or quantifying. A noise metric quantifies the noise environment. There are three families of noise metrics described herein – one for single noise events such as an aircraft flyby, one for cumulative noise events such as a day's worth of aircraft activity, and one which quantifies the events or time relative to single noise events.

Within the single noise event family, metrics described below include Peak Sound Pressure Level (L_{pk}), Maximum Sound Level (L_{max}) and Sound Exposure Level (SEL). Within the cumulative noise events family, metrics described below include Equivalent Sound Level (L_{eq}), Day-Night Average Sound Level (DNL or L_{dn}), and several others. Within the events/time family, metrics described below include Number of Events Above a Threshold Level and Time Above a Specified Level.

Maximum Sound Level (L_{max})

The highest A-weighted integrated sound level measured during a single event in which the sound level changes value with time (e.g., an aircraft overflight) is called the maximum A-weighted sound level or L_{max}.



Source: State of California Department of Transportation 2002.

Figure C-2. Typical Decibel Level of Common Sounds

During an aircraft overflight, the noise level starts at the ambient or background noise level, rises to the maximum level as the aircraft flies closest to the observer, and returns to the background level as the aircraft recedes into the distance. The L_{max} indicates the maximum sound level occurring for a fraction of a second. For aircraft noise, the "fraction of a second" over which the maximum level is defined is generally one-eighth of a second, and is denoted as "fast" response (ANSI 1988). Slowly varying or steady sounds are generally measured over a period of one second, denoted "slow" response. The L_{max} is important in judging the interference caused by a noise event with conversation, TV or radio listening, sleep, or other common activities. Although it provides some measure of the intrusiveness of the event, it does not completely describe the total event, because it does not include the period of time that the sound is heard.

Sound Exposure Level (SEL)

SEL is a composite metric that represents both the intensity of a sound and its duration. Individual time-varying noise events (e.g., aircraft overflights) have two main characteristics: a sound level that changes throughout the event and a period of time during which the event is heard. SEL provides a measure of the net impact of the entire acoustic event, but it does not directly represent the sound level heard at any given time. During an aircraft flyover, SEL would include both the L_{max} and the lower noise levels produced during onset and recess periods of the overflight.

SEL is a logarithmic measure of the total acoustic energy transmitted to the listener during the event. Mathematically, it represents the sound level of a constant sound that would, in one second, generate the same acoustic energy as the actual time-varying noise event. For sound from aircraft overflights, which typically lasts more than one second, the SEL is usually greater than the L_{max} because an individual overflight takes seconds and the L_{max} occurs instantaneously. SEL represents the best metric to compare noise levels from overflights.

Equivalent Sound Level (L_{eq})

A cumulative noise metric useful in describing noise is the L_{eq}. L_{eq} is the continuous sound level that would be present if all of the variations in sound level occurring over a specified time period were smoothed out as to contain the same total sound energy.

Just as SEL has proven to be a good measure of the noise impact of a single event, L_{eq} has been established to be a good measure of the impact of a series of events during a given time period. Also, while L_{eq} is defined as an average, it is effectively a sum over that time period and is, thus, a measure of the cumulative impact of noise. For example, the sum of all noise-generating events during the period of 7 a.m. to 4 p.m. could provide the relative impact of noise generating events for a school day.

2. Noise Effects

This noise effects section includes discussions of annoyance, speech interference and sleep disturbance, and the effects of noise on hearing, health, performance, learning, animals, property values, terrain and archaeological sites.

2.1 Annoyance

The primary effect of aircraft noise on exposed communities is one of long-term annoyance, defined by the USEPA as any negative subjective reaction on the part of an individual or group. The scientific community has adopted the use of long-term annoyance as a primary indicator of community response because it attempts to account for all negative aspects of effects from noise, e.g., increased annoyance due to being awakened the previous night by aircraft and interference with everyday conversation.

Numerous laboratory studies and field surveys have been conducted to measure annoyance and to account for a number of variables, many of which are dependent on a person’s individual circumstances and preferences. Laboratory studies of individual response to noise have helped isolate a number of the factors contributing to annoyance, such as the intensity level and spectral characteristics of the noise, duration, the presence of impulses, pitch, information content, and the degree of interference with activity. Social surveys of community response to noise have allowed the development of general dose-response relationships that can be used to estimate the proportion of people who will be highly annoyed by a given noise level. The results of these studies have formed the basis for criteria established to define areas of compatible land use.

A wide variety of responses have been used to determine intrusiveness of noise and disturbances of speech, sleep, audio/video entertainment, and outdoor living; but the most useful metric for assessing peoples’ responses to noise is the percentage of the population expected to be “highly annoyed.” The concept of “percent highly annoyed” has provided the most consistent response of a community to a particular noise environment. In his synthesis of several different social surveys that employed different response scales, Schultz (1978) defined “highly annoyed” respondents as those respondents whose self-described annoyance fell within the upper 28 percent of the response scale where the scale was numerical or un-named. For surveys where the response scale was named, Schultz counted those who claimed to be highly annoyed, combining the responses of “very annoyed” and “extremely annoyed.” Schultz’s definition of “percent highly annoyed” (%HA) became the basis for the federal policy on environmental noise. Daily average sound levels are typically used for the evaluation of community noise effects, such as long-term annoyance.

In general, scientific studies and social surveys have found a correlation between the percentages of groups of people highly annoyed and the level of average noise exposure. Thus, the results are expressed as the average %HA at various exposure levels measured in DNL. The classic analysis is Schultz's original 1978 study, whose results are shown in Figure C-3. This figure is commonly referred to as the Schultz curve. It represents the synthesis of a large number of social surveys (161 data points in all), that relates the long-term community response to various types of noise sources, measured using the DNL metric.

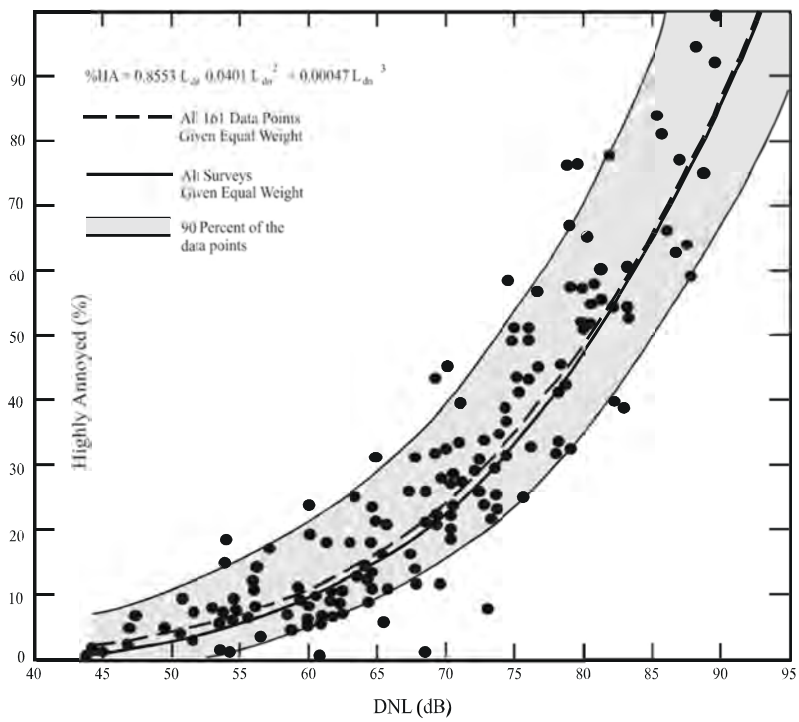
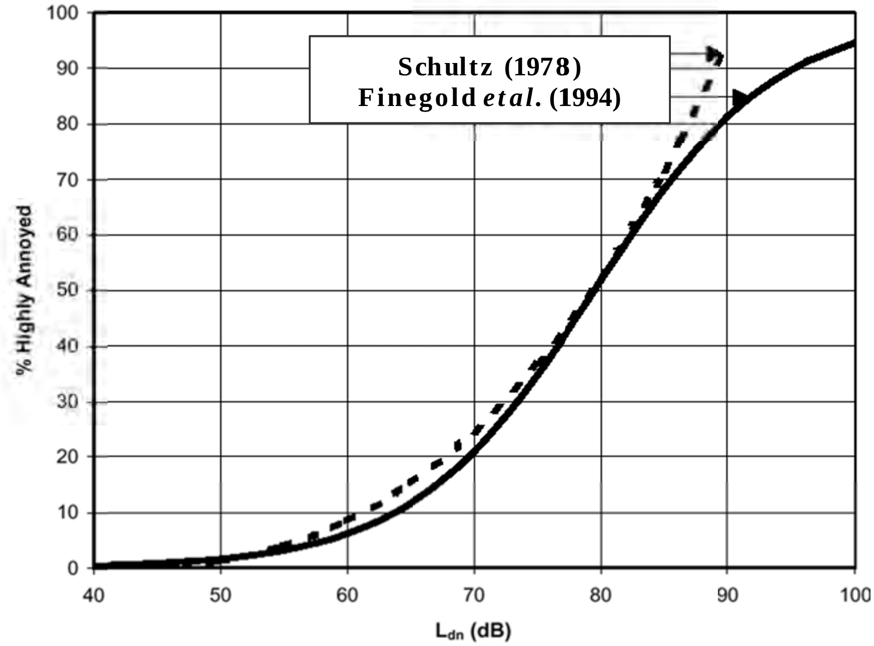


Figure C-3. Community Surveys of Noise Annoyance

An updated study of the original Schultz data based on the analysis of 400 data points collected through 1989 essentially reaffirmed this relationship. Figure C-4 shows an updated form of the curve fit in comparison with the original Schultz curve (Finegold *et al.* 1994). The updated fit, which does not differ substantially from the original, is the preferred form in the U.S. The relationship between %HA and DNL is:

$$\%HA = 100/[1 + \exp(11.13 - 0.141L_{dn})]$$



Sources: (Schultz 1978) and Current (Finegold *et al.* 1994) Curve Fits

Figure C-4. Response of Communities to Noise; Comparison of Original

In general, correlation coefficients of 0.85 to 0.95 are found between the percentages of groups of people highly annoyed and the level of average noise exposure. However, the correlation coefficients for the annoyance of individuals are relatively low, on the order of 0.5 or less. This is not surprising, considering the varying personal factors that influence the manner in which individuals react to noise.

A number of non-acoustic factors have been identified that may influence the annoyance response of an individual. Newman and Beattie (1985) divided these factors into emotional and physical variables.

Emotional Variables:

- Feelings about the necessity or preventability of the noise;
- Judgment of the importance and value of the activity that is producing the noise;
- Activity at the time an individual hears the noise;
- Attitude about the environment;
- General sensitivity to noise;

- Belief about the effect of noise on health; and
- Feeling of fear associated with the noise.

Physical Variables:

- Type of neighborhood;
- Time of day;
- Season;
- Predictability of noise;
- Control over the noise source; and
- Length of time an individual is exposed to a noise.

The low correlation coefficients for individuals' reactions reflect the large amount of scatter among the data drawn from the various surveys and point to the substantial uncertainty associated with the equation representing the relationship between %HA and DNL. Based on the results of surveys it has been observed that noise exposure can explain less than 50 percent of the observed variance in annoyance, indicating that non-acoustical factors play a major role. As a result, it is not possible to accurately predict individual annoyance in any specific community based on the aircraft noise exposure. Nevertheless, changes in %HA can be useful in giving the decision maker more information about the relative effects that different alternatives may have on the community.

The original Schultz curve and the subsequent updates do not separate out the annoyance from aircraft noise and other transportation noise sources. This was an important element, in that it allowed Schultz to obtain some consensus among the various social surveys from the 1960s and 1970s that were synthesized in the analysis. In essence, the Schultz curve assumes that the effects of long-term annoyance on the general population are the same, regardless of whether the noise source is road, rail, or aircraft. In the years after the classical Schultz analysis, additional social surveys have been conducted to better understand the annoyance effects of various transportation sources.

Miedema and Vos (1998) present synthesis curves for the relationship between DNL and percentage "Annoyed" and percentage "Highly Annoyed" for three transportation noise sources. Separate, non-identical curves were found for aircraft, road traffic, and railway noise. Table C-1 illustrates that, for a DNL of 65 dB, the percent of the people forecasted to be Highly Annoyed is

28 percent for air traffic, 18 percent for road traffic, and 11 percent for railroad traffic. For an outdoor DNL of 55 dB, the percent highly annoyed would be close to 12 percent if the noise is generated by aircraft operations, but only 7 percent and 4 percent, respectively, if the noise is generated by road or rail traffic. Comparing the levels on the Miedema and Vos curve to those on the updated Schultz curve indicates that the percentage of people highly annoyed by aircraft noise may be higher than previously thought when the noise is solely generated by aircraft activity.

Table C-1. Percent Highly Annoyed for Different Transportation Noise Sources

DNL (dB)	PERCENT HIGHLY ANNOYED (%HA)			
	Miedema and Vos			*Schultz Combined*
	Air	*Road*	*Rail*	
55	12	7	4	3
60	19	12	7	6
65	28	18	11	12
70	37	29	16	22
75	48	40	22	36

Source: Miedema and Vos 1998

As noted by the World Health Organization (WHO), even though aircraft noise seems to produce a stronger annoyance response than road traffic, caution should be exercised when interpreting synthesized data from different studies (WHO 2000). The WHO noted that five major parameters should be randomly distributed for the analyses to be valid: personal, demographic, and lifestyle factors, as well as the duration of noise exposure and the population experience with noise.

The Federal Interagency Committee on Noise (FICON) found that the updated Schultz curve remains the best available source of empirical dosage effect information to predict community response to transportation noise without any segregation by transportation source (FICON 1992); a position held by the FICAN in 1997 (FICAN 1997). However, FICON also recommended further research to investigate the differences in perceptions of aircraft noise, ground transportation noise (highways and railroads), and general background noise.

2.2 Speech Interference

Speech interference associated with aircraft noise is a primary cause of annoyance for communities. The disruption of routine activities such as radio or television listening, telephone use, or family conversation gives rise to frustration and irritation. The quality of speech communication is particularly important in classrooms and offices. In industrial settings it can cause fatigue and vocal strain in those who attempt to communicate over the noise.

The disruption of speech in the classroom is a primary concern, due to the potential for adverse effects on children's learning ability. There are two aspects to speech comprehension:

1. *Word Intelligibility* - the percent of words transmitted and received. This might be important for students in the lower grades who are learning the English language, and particularly for students who have English as a Second Language.

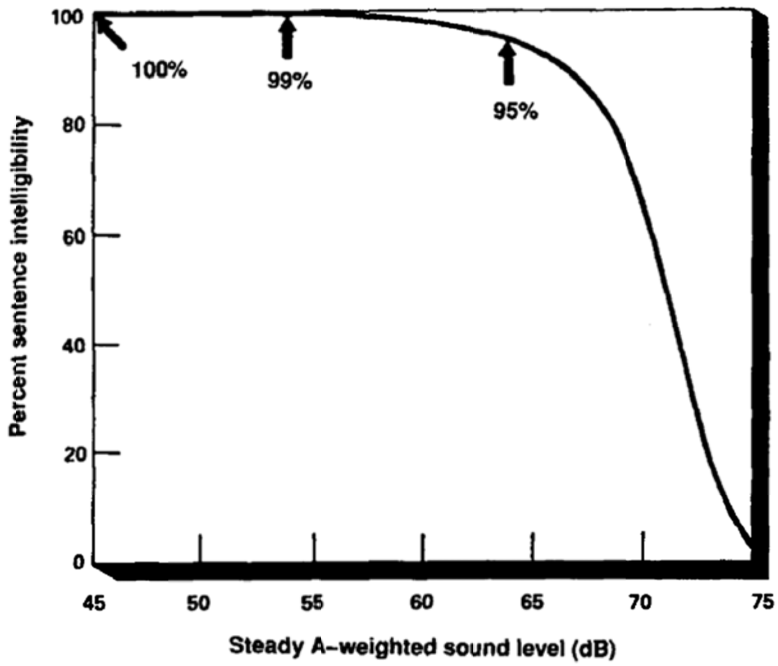
2. *Sentence Intelligibility* – the percent of sentences transmitted and understood. This might be important for high-school students and adults who are familiar with the language, and who do not necessarily have to understand each word in order to understand sentences.

For teachers to be clearly understood by their students, it is important that regular voice communication is clear and uninterrupted. Not only does the background sound level have to be low enough for the teacher to be clearly heard, but intermittent outdoor noise events also need to be minimized. It is therefore important to evaluate the steady background level, the level of voice communication, and the single-event level due to aircraft overflights that might interfere with speech.

Several research studies have been conducted and guideline documents been developed resulting in a fairly consistent set of noise level criteria for speech interference. This section provides an overview of the results of these studies.

U.S. Federal Criteria for Interior Noise

In 1974, the USEPA identified a goal of an indoor 24-hour average sound level $L_{eq(24)}$ of 45 dB to minimize speech interference based on the intelligibility of sentences in the presence of a steady background noise (USEPA 1974). Intelligibility pertains to the percentage of speech units correctly understood out of those transmitted, and specifies the type of speech material used, i.e., sentences or words. The curve displayed in Figure C-5 shows the effect of steady indoor background sound levels on sentence intelligibility. For an average adult with normal hearing and fluency in the language, steady background sound levels indoors of less than 45 dB L_{eq} are expected to allow 100 percent intelligibility of sentences.



Source: USEPA 1974

Figure C-5. Speech Intelligibility Curve

The curve shows 99 percent sentence intelligibility for background levels at a L_{eq} of 54 dB, and less than 10 percent intelligibility for background levels above a L_{eq} of 73 dB. Note that the curve is especially sensitive to changes in sound level between 65 dB and 75 dB - an increase of 1 dB in background sound level from 70 dB to 71 dB results in a 14 percent decrease in sentence intelligibility, whereas a 1 dB increase in background sound level from 60 dB to 61 dB results in less than 1 percent decrease in sentence intelligibility.

Summary

As the previous section demonstrates, research indicates that it is not only important to consider the continuous background levels using time-averaged metrics, but also the intermittent events, using single-event metrics such as L_{max}. Table C-2 provides a summary of the noise level criteria recommended in the scientific literature.

Table C-2. Indoor Noise Level Criteria Based on Speech Intelligibility

Source	*Metric/Level (dB)*	*Effects and Notes*
FAA (1985)	L_{eq}(during school hours) = 45 dB	Federal assistance criteria for school sound insulation; supplemental single-event criteria may be used
Lind *et al.* (1998), Sharp and Plotkin (1984), Wesler (1986)	L_{max} = 50 dB / SIL 45	Single event level permissible in the classroom
WHO (2000)	L_{eq} = 35 dB Lmax = 50 dB	Assumes average speech level of 50 dB and recommends signal to noise ratio of 15 dB
ANSI (2002)	L_{eq} = 40 dB, Based on Room Volume	Acceptable background level for continuous noise/ relaxed criteria for intermittent noise in the classroom
UKDFES (2003)	$L_{eq(30min)}$ = 30-35 dB L_{max} = 55 dB	Minimum acceptable in classroom and most other learning environs

When considering intermittent noise caused by aircraft overflights, a review of the relevant scientific literature and international guidelines indicates that an appropriate criteria is a limit on indoor background noise levels of 35 to 40 dB L_{eq} and a limit on single events of 50 dB L_{max}.

2.3 Sleep Disturbance

The disturbance of sleep is a major concern for communities exposed to nighttime aircraft noise. There have been numerous research studies that have attempted to quantify the complex effects of noise on sleep. This section provides an overview of the major noise-induced sleep disturbance studies that have been conducted, with particular emphasis placed on those studies that have influenced U.S. federal noise policy. The studies have been separated into two groups:

1. Initial studies performed in the 1960s and 1970s, where the research was focused on laboratory sleep observations.

2. Later studies performed in the 1990s up to the present, where the research was focused on field observations, and correlations to laboratory research were sought.

2.3.1 Initial Studies

The relationship between noise levels and sleep disturbance is complex and not fully understood. The disturbance depends not only on the depth of sleep, but also on the previous exposure to aircraft noise, familiarity with the surroundings, the physiological and psychological condition of the recipient, and a host of other situational factors. The most readily measurable effect of noise on sleep is the number of arousals or awakenings, and so the body of scientific literature has focused on predicting the percentage of the population that will be awakened at various noise levels. Fundamentally, regardless of the tools used to measure the degree of sleep disturbance (awakenings, arousals, etc.), these studies have grouped the data points into bins to predict the percentage of the population likely to be disturbed at various sound level thresholds.

FICON produced a guidance document that provided an overview of the most pertinent sleep disturbance research that had been conducted throughout the 1970s (FICON 1992). Literature reviews and meta-analysis conducted between 1978 and 1989 made use of the existing datasets that indicated the effects of nighttime noise on various sleep-state changes and awakenings (Lukas 1978, Griefahn 1978, Pearsons *et al.* 1989). FICON noted that various indoor A-weighted sound levels ranging from 25 to 50 dB were observed to be thresholds below which significant sleep effects were not expected. Due to the large variability in the data, FICON did not endorse the reliability of the results.

However, FICON did recommend the use of an interim dose-response curve—awaiting future research—which predicted the percent of the exposed population expected to be awakened as a function of the exposure to single event noise levels expressed in terms of SEL. This curve was based on the research conducted for the U.S. Air Force (USAF) (Finegold *et al.* 1994). The dataset included most of the research performed up to that point, and predicted that 10 percent of the population would be awakened when exposed to an interior SEL of approximately 58 dB. The data utilized to derive this relationship were primarily the results of controlled laboratory studies.

2.3.2 Recent Sleep Disturbance Research – Field and Laboratory Studies

It was noted in the early sleep disturbance research that the controlled laboratory studies did not account for many factors that are important to sleep behavior, such as habituation to the environment and previous exposure to noise and awakenings from sources other than aircraft noise. In the early 1990s, field studies were conducted to validate the earlier laboratory work. The most significant finding from these studies was that an estimated 80 to 90 percent of sleep disturbances were not related to individual outdoor noise events, but were instead the result of indoor noise sources and other non-noise-related factors. The results showed that there was less of an effect of noise on sleep in real-life conditions than had been previously reported from laboratory studies.

2.3.3 Federal Interagency Committee on Aviation Noise

The interim FICON dose-response curve that was recommended for use in 1992 was based on the most pertinent sleep disturbance research that was conducted through the 1970s, primarily in laboratory settings. After that time, considerable field research was conducted to evaluate the sleep effects in peoples' normal, home environment. Laboratory sleep studies tend to show higher values of sleep disturbance than field studies because people who sleep in their own homes are habituated to their environment and, therefore, do not wake up as easily (FICAN 1997).

Based on the new information, FICAN updated its recommended dose-response curve in 1997, depicted as the lower curve in Figure C-6. This figure is based on the results of three field studies (Ollerhead *et al.* 1992, Fidell *et al.* 1994, 1995a, and 1995b), along with the datasets from six previous field studies.

The new relationship represents the higher end, or upper envelope, of the latest field data. It should be interpreted as predicting the "maximum percent of the exposed population expected to be behaviorally awakened" or the "maximum percent awakened" for a given residential population. According to this relationship, a maximum of 3 percent of people would be awakened at an indoor SEL of 58 dB, compared to 10 percent using the 1992 curve. An indoor SEL of 58 dB is equivalent to outdoor SEL's of 73 and 83 dB respectively assuming 15 and 25 dB noise level reduction from outdoor to indoor with windows open and closed, respectively.

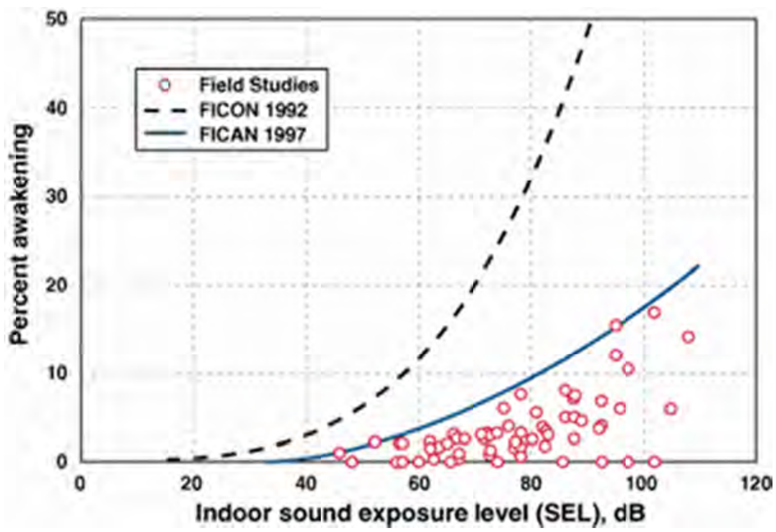


Figure C-6. FICAN's 1997 Recommended Sleep Disturbance Dose-Response Relationship

The FICAN 1997 curve is represented by the following equation:

$$\text{Percent Awakenings} = 0.0087 \text{ x } [\text{SEL} - 30]^{1.79}$$

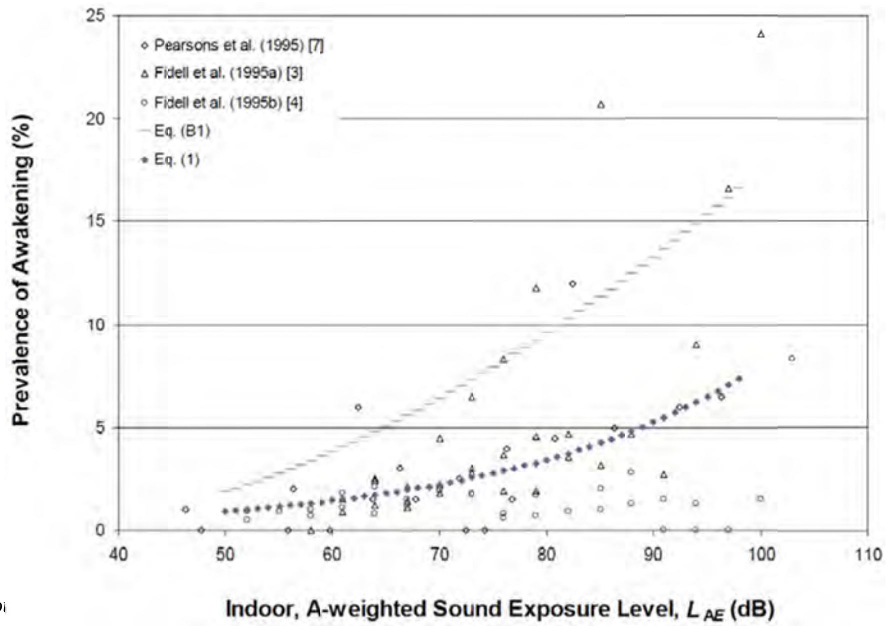
Note the relatively low percentage of awakenings to fairly high noise levels. People think they are awakened by a noise event, but usually the reason for awakening is otherwise. For example, the 1992 United Kingdom Civil Aviation Authority study found the average person was awakened about 18 times per night for reasons other than exposure to an aircraft noise – some of these awakenings are due to the biological rhythms of sleep and some to other reasons that were not correlated with specific aircraft events.

2.3.4 Number of Events and Awakenings

In recent years, there have been studies and one proposal that attempted to determine the effect of multiple aircraft events on the number of awakenings. The German Aerospace Center (DLR) conducted an extensive study focused on the effects of nighttime aircraft noise on sleep and other related human performance factors (Basner 2004). The DLR study was one of the largest studies to examine the link between aircraft noise and sleep disturbance and involved both laboratory and in-home field research phases. The DLR investigators developed a dose-effect curve that predicts the number of aircraft events at various values of L_{max} expected to produce one additional awakening over the course of a night. The dose-effect curve was based on the relationships found in the field studies.

In July 2008 ANSI and the Acoustical Society of America (ASA) published a method to estimate the percent of the exposed population that might be awakened by multiple aircraft noise events based on statistical assumptions about the probability of awakening (or not awakening) (ANSI 2008). This method relies on probability theory rather than direct field research/experimental data to account for multiple events.

Figure C-7 depicts the awakenings data that form the basis and equations of ANSI S12.9-2008. The curve labeled ‘Eq. (B1)’ is the relationship between noise and awakening endorsed by FICAN in 1997. The ANSI recommended curve labeled ‘Eq. (1)’ quantifies the probability of awakening for a population of sleepers who are exposed to an outdoor noise event as a function of the associated indoor SEL in the bedroom. This curve was derived from studies of behavioral awakenings associated with noise events in “steady state” situations where the population has been exposed to the noise long enough to be habituated. The data points in Figure B-7 come from these studies. Unlike the FICAN curve, the ANSI 2008 curve represents the average of the field research data points.



So

Figure C-7. Plot of Sleep Awakening Data versus Indoor SEL

In December 2008, FICAN recommended the use of this new estimation procedure for future analyses of behavioral awakenings from aircraft noise. In that statement, FICAN also recognized that additional sleep disturbance research is underway by various research organizations, and results of that work may result in additional changes to FICAN's position. Until that time, FICAN recommends the use of ANSI S12.9-2008.

2.4 Noise-Induced Hearing Impairment

This section provides a brief overview of hearing loss caused by noise exposure. The goal is to provide a sense of perspective as to how aircraft noise (as experienced on the ground) compares to other activities that are often linked with hearing loss.

2.4.1 Hearing Threshold Shifts

Hearing loss is generally interpreted as a decrease in the ear's sensitivity or acuity to perceive sound; i.e., a shift in the hearing threshold to a higher level. This change can either be a Temporary Threshold Shift (TTS), or a Permanent Threshold Shift (PTS) (Berger *et al.* 1995).

TTS can result from exposure to loud noise over a given amount of time, yet the hearing loss is not necessarily permanent. An example of TTS might be a person attending a loud music concert. After the concert is over, the person may experience a threshold shift that may last several hours, depending upon the level and duration of exposure. While experiencing TTS, the person becomes less sensitive to low-level sounds, particularly at certain frequencies in the speech range (typically near 4,000 Hz). Normal hearing ability eventually returns, as long as the person has enough time to recover within a relatively quiet environment.

PTS usually results from repeated exposure to high noise levels, where the ears are not given adequate time to recover from the strain and fatigue of exposure. A common example of PTS is the result of working in a loud environment such as a factory. It is important to note that a temporary shift (TTS) can eventually become permanent (PTS) over time with continuous exposure to high noise levels. Thus, even if the ear is given time to recover from TTS, repeated occurrence of TTS may eventually lead to permanent hearing loss. The point at which a TTS results in a PTS is difficult to identify and varies with a person's sensitivity.

2.4.2 Criteria for Permanent Hearing Loss

Considerable data on hearing loss have been collected and analyzed by the scientific/medical community. It has been well established that continuous exposure to high noise levels will damage human hearing (USEPA 1978). The Occupational Safety and Health Administration (OSHA) regulation of 1971 standardizes the limits on workplace noise exposure for protection from hearing loss as an average level of 90 dB over an 8-hour work period or 85 dB over a 16-hour period (the average level is based on a 5 dB decrease per doubling of exposure time) (U.S. Department of Labor 1971). Even the most protective criterion (no measurable hearing loss for the most sensitive portion of the population at the ear's most sensitive frequency, 4,000 Hz, after a 40-year exposure) is an average sound level of 70 dB over a 24-hour period.

The USEPA established 75 dB for an 8-hour exposure and 70 dB for a 24-hour exposure as the average noise level standard requisite to protect 96 percent of the population from greater than a 5 dB PTS (USEPA 1978). The National Academy of Sciences Committee on Hearing, Bioacoustics, and Biomechanics (CHABA) identified 75 dB as the minimum level at which hearing loss may occur (CHABA 1977). Finally, the WHO has concluded that environmental and leisure-time noise below an $L_{eq(24)}$ value of 70 dB "will not cause hearing loss in the large majority of the population, even after a lifetime of exposure" (WHO 2000).

2.4.3 Hearing Loss and Aircraft Noise

The 1982 USEPA Guidelines report specifically addresses the criteria and procedures for assessing the noise-induced hearing loss in terms of the Noise-Induced Permanent Threshold Shift (NIPTS), a quantity that defines the permanent change in hearing level, or threshold, caused by exposure to noise (USEPA 1982). Numerically, the NIPTS is the change in threshold averaged over the frequencies 0.5, 1, 2, and 4 kHz that can be expected from daily exposure to noise over a normal working lifetime of 40 years, with the exposure beginning at an age of 20 years. A grand average of the NIPTS over time (40 years) and hearing sensitivity (10 to 90 percentiles of the exposed population) is termed the Average NIPTS, or Ave NIPTS for short. The Ave NIPTS that can be expected for noise exposure as measured by the DNL metric is given in Table C-3.

Table C-3. Ave NIPTS and 10th Percentile NIPTS as a Function of DNL

DNL	*Ave NIPTS dB**	*10th Percentile NIPTS dB**
75-76	1.0	4.0
76-77	1.0	4.5
77-78	1.6	5.0
78-79	2.0	5.5
79-80	2.5	6.0
80-81	3.0	7.0
81-82	3.5	8.0
82-83	4.0	9.0
83-84	4.5	10.0
84-85	5.5	11.0

*Note:**Rounded to the nearest 0.5 dB

For example, for a noise exposure of 80 dB DNL, the expected lifetime average value of NIPTS is 2.5 dB, or 6.0 dB for the 10th percentile. Characterizing the noise exposure in terms of DNL will usually overestimate the assessment of hearing loss risk as DNL includes a 10 dB weighting factor for aircraft operations occurring between 10 p.m. and 7 a.m. If, however, flight operations between the hours of 10 p.m. and 7 a.m. account for 5 percent or less of the total 24-hour operations, the overestimation is on the order of 1.5 dB. From a civilian airport perspective, the scientific community has concluded that there is little likelihood that the resulting noise exposure from aircraft noise could result in either a temporary or permanent hearing loss. Studies on community hearing loss from exposure to aircraft flyovers near airports showed that there is no danger, under normal circumstances, of hearing loss due to aircraft noise (Newman and Beattie 1985). The USEPA criterion ($L_{eq(24)}$ = 70 dBA) can be exceeded in some areas located near airports, but that is only the case outdoors. Inside a building, where people are more likely to spend most of their time, the average noise level will be much less than 70 dBA (Eldred and von Gierke 1993). Eldred and von Gierke also report that "several studies in the U.S., Japan, and the United Kingdom have confirmed the predictions that the possibility for permanent hearing loss in communities, even under the most intense commercial take-off and landing patterns, is remote."

With regard to military airbases, as individual aircraft noise levels are increasing with the introduction of new aircraft, a 2009 Department of Defense (DoD) policy directive requires that hearing loss risk be estimated for the at risk population, defined as the population exposed to DNL greater than or equal to 80 dB (Undersecretary of Defense for Acquisition, Technology and Logistics 2009). Specifically, DoD components are directed to "use the 80 Day-Night A-Weighted (DNL) noise contour to identify populations at the most risk of potential hearing loss."

This does not preclude populations outside the 80 DNL contour, i.e., at lower exposure levels, from being at some degree of risk of hearing loss. However, the analysis should be restricted to populations within this contour area, including residents of on-base housing. The exposure of workers inside the base boundary area should be considered occupational and evaluated using the appropriate DoD component regulations for occupational noise exposure.

2.4.4 Summary

Aviation and typical community noise levels near airports are not comparable to the occupational or recreational noise exposures associated with hearing loss. Studies of aircraft noise levels associated with civilian airport activity have not definitively correlated permanent hearing impairment with aircraft activity. It is unlikely that airport neighbors will remain outside their homes 24 hours per day, so there is little likelihood of hearing loss below an average sound level of 75 dB DNL. Near military airbases, average noise levels above 75 dB may occur, and while new DoD policy dictates that NIPTS be evaluated, no research results to date have definitively related permanent hearing impairment to aviation noise.

2.5 Non-auditory Health Effects

Nonauditory health effects of long-term noise exposure, where noise may act as a risk factor, have not been found to occur at levels below those protective against noise-induced hearing loss, described above. Most studies attempting to clarify such health effects have found that noise exposure levels established for hearing protection will also protect against any potential nonauditory health effects, at least in workplace conditions. The best scientific summary of these findings is contained in the lead paper at the National Institutes of Health Conference on Noise and Hearing Loss, held on January 22–24, 1990, in Washington, D.C., which states "The nonauditory effects of chronic noise exposure, when noise is suspected to act as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders, have never been proven to occur as chronic manifestations at levels below these criteria (an average of 75 dBA for complete protection against hearing loss for an eight-hour day)" (von Gierke 1990; parenthetical wording added for clarification). At the International Congress (1988) on Noise as a Public Health Problem, most studies attempting to clarify such health effects did not find them at levels below the criteria protective of noise-induced hearing loss; and even above these criteria, results regarding such health effects were ambiguous.

Consequently, it can be concluded that establishing and enforcing exposure levels protecting against noise-induced hearing loss would not only solve the noise-induced hearing loss problem but also any potential nonauditory health effects in the work place.

Although these findings were directed specifically at noise effects in the work place, they are equally applicable to aircraft noise effects in the community environment. Research studies regarding the nonauditory health effects of aircraft noise are ambiguous, at best, and often contradictory. Yet, even those studies which purport to find such health effects use time-average noise levels of 75 dB and higher for their research.

For example, in an often-quoted paper, two University of California at Los Angeles researchers found a relation between aircraft noise levels under the approach path to Los Angeles International Airport and increased mortality rates among the exposed residents by using an average noise exposure level greater than 75 dB for the "noise-exposed" population (Meecham and Shaw 1979). Nevertheless, three other University of California at Los Angeles professors analyzed those same data and found no relation between noise exposure and mortality rates (Frerichs *et al*. 1980).

As a second example, two other University of California at Los Angeles researchers used this same population near Los Angeles International Airport to show a higher rate of birth defects during the period of 1970 to 1972 when compared with a control group residing away from the airport (Jones and Tauscher 1978). Based on this report, a separate group at the United States Centers for Disease Control performed a more thorough study of populations near Atlanta's Hartsfield International Airport for 1970 to 1972 and found no relation in their study of 17 identified categories of birth defects to aircraft noise levels above 65 dB (Edmonds *et al.* 1979).

A recent review of health effects, prepared by a Committee of the Health Council of The Netherlands (Committee of the Health Council of the Netherlands 1996), analyzed currently available published information on this topic. The committee concluded that the threshold for possible long-term health effects was a 16-hour (6:00 a.m. to 10:00 p.m.) L_{eq} of 70 dB. Projecting this to 24 hours and applying the 10 dB nighttime penalty used with DNL, this corresponds to DNL of about 75 dB. The study also affirmed the risk threshold for hearing loss, as discussed earlier.

In summary, there is no scientific basis for a claim that potential health effects exist for aircraft time-average sound levels below 75 dB. The potential for noise to affect physiological health, such as the cardiovascular system, has been speculated; however, no unequivocal evidence exists to support such claims (Harris 1997). Conclusions drawn from a review of health effect studies involving military low-altitude flight noise with its unusually high maximum levels and rapid rise in sound level have shown no increase in cardiovascular disease (Schwartze and Thompson 1993). Additional claims that are unsupported include flyover noise producing increased mortality rates and increases in cardiovascular death, aggravation of post-traumatic stress syndrome, increased stress, increase in admissions to mental hospitals, and adverse effects on pregnant women and the unborn fetus (Harris 1997).

2.5.1 Performance Effects

The effect of noise on the performance of activities or tasks has been the subject of many studies. Some of these studies have established links between continuous high noise levels and performance loss. Noise-induced performance losses are most frequently reported in studies employing noise levels in excess of 85 dB. Little change has been found in low-noise cases. It has been cited that moderate noise levels appear to act as a stressor for more sensitive individuals performing a difficult psychomotor task.

While the results of research on the general effect of periodic aircraft noise on performance have yet to yield definitive criteria, several general trends have been noted including:

- A periodic intermittent noise is more likely to disrupt performance than a steady-state continuous noise of the same level. Flyover noise, due to its intermittent nature, might be more likely to disrupt performance than a steady-state noise of equal level.
- Noise is more inclined to affect the quality than the quantity of work.
- Noise is more likely to impair the performance of tasks that place extreme demands on the worker.

2.6 Noise Effects on Children

In response to noise-specific and other environmental studies, Executive Order (EO) 13045, *Protection of Children from Environmental Health Risks and Safety Risks* (1997), requires federal agencies to ensure that policies, programs, and activities address environmental health and safety risks to identify any disproportionate risks to children.

A review of the scientific literature indicates that there has not been a tremendous amount of research in the area of aircraft noise effects on children. The research reviewed does suggest that environments with sustained high background noise can have variable effects, including noise effects on learning and cognitive abilities, and reports of various noise-related physiological changes.

2.6.1 Effects on Learning and Cognitive Abilities

In 2002, ANSI refers to studies that suggest that loud and frequent background noise can affect the learning patterns of young children (ANSI 2002). ANSI provides discussion on the relationships between noise and learning, and stipulates design requirements and acoustical performance criteria for outdoor-to-indoor noise isolation. School design is directed to be cognizant of, and responsive to surrounding land uses and the shielding of outdoor noise from the indoor environment. The ANSI acoustical performance criteria for schools include the requirement that the one-hour-average background noise level shall not exceed 35 dBA in core learning spaces smaller than 20,000 cubic feet and 40 dBA in core learning spaces with enclosed volumes exceeding 20,000 cubic feet. This would require schools be constructed such that, in quiet neighborhoods indoor noise levels are lowered by 15 to 20 dBA relative to outdoor levels. In schools near airports, indoor noise levels would have to be lowered by 35 to 45 dBA relative to outdoor levels (ANSI 2002).

The studies referenced by ANSI to support the new standard are not specific to jet aircraft noise and the potential effects on children. However, there are references to studies that have shown that children in noisier classrooms scored lower on a variety of tests. Excessive background noise or reverberation within schools causes interferences of communication and can therefore create an acoustical barrier to learning (ANSI 2002). Studies have been performed that contribute to the body of evidence emphasizing the importance of communication by way of the spoken language to the development of cognitive skills. The ability to read, write, comprehend, and maintain attentiveness, is in part, based upon whether teacher communication is consistently intelligible (ANSI 2002).

Numerous studies have shown varying degrees of effects of noise on the reading comprehension, attentiveness, puzzle-solving, and memory/recall ability of children. It is generally accepted that young children are more susceptible than adults to the effects of background noise. Because of the developmental status of young children (linguistic, cognitive, and proficiency), barriers to hearing can cause interferences or disruptions in developmental evolution.

Research on the impacts of aircraft noise, and noise in general, on the cognitive abilities of school-aged children has received more attention in recent years. Several studies suggest that aircraft noise can affect the academic performance of schoolchildren. Although many factors could contribute to learning deficits in school-aged children (e.g., socioeconomic level, home environment, diet, sleep patterns), evidence exists that suggests that chronic exposure to high aircraft noise levels can impair learning.

Specifically, elementary school children attending schools near New York City’s two airports demonstrated lower reading scores than children living farther away from the flight paths (Green *et al.* 1982). Researchers have found that tasks involving central processing and language comprehension (such as reading, attention, problem solving, and memory) appear to be the most affected by noise (Evans and Lepore 1993, Hygge 1994, and Evans *et al.* 1998). It has been demonstrated that chronic exposure of first- and second-grade children to aircraft noise can result in reading deficits and impaired speech perception (i.e., the ability to hear common, low-frequency [vowel] sounds but not high frequencies [consonants] in speech) (Evans and Maxwell 1997).

The Evans and Maxwell (1997) study found that chronic exposure to aircraft noise resulted in reading deficits and impaired speech perception for first- and second-grade children. Other studies found that children residing near the LAX had more difficulty solving cognitive problems and did not perform as well as children from quieter schools in puzzle-solving and attentiveness (Bronzaft 1997, Cohen *et al.* 1980). Children attending elementary schools in high aircraft noise areas near London's Heathrow Airport demonstrated poorer reading comprehension and selective cognitive impairments (Haines *et al.* 2001a and 2001b). Similarly, a 1994 study found that students exposed to aircraft noise of approximately 76 dBA scored 20 percent lower on recall ability tests than students exposed to ambient noise of 42-44 dBA (Hygge 1994). Similar studies involving the testing of attention, memory, and reading comprehension of school children located near airports showed that their tests exhibited reduced performance results compared to those of similar groups of children who were located in quieter environments (Evans *et al.* 1998, Haines *et al.* 1998). The Haines and Stansfeld study indicated that there may be some long-term effects associated with exposure, as one-year follow-up testing still demonstrated lowered scores for children in higher noise schools (Haines *et al.* 2001a and 2001b). In contrast, a 2002 study found that although children living near the old Munich airport scored lower in standardized reading and long-term memory tests than a control group, their performance on the same tests was equal to that of the control group once the airport was closed (Hygge *et al.* 2002).

Finally, although it is recognized that there are many factors that could contribute to learning deficits in school-aged children, there is increasing awareness that chronic exposure to high aircraft noise levels may impair learning. This awareness has led the WHO and a North Atlantic Treaty Organization working group to conclude that daycare centers and schools should not be located near major sources of noise, such as highways, airports, and industrial sites (WHO 2000, North Atlantic Treaty Organization 2000).

2.6.2 Health Effects

Physiological effects in children exposed to aircraft noise and the potential for health effects have also been the focus of limited investigation. Studies in the literature include examination of blood pressure levels, hormonal secretions, and hearing loss.

As a measure of stress response to aircraft noise, authors have looked at blood pressure readings to monitor children's health. Children who were chronically exposed to aircraft noise from a new airport near Munich, Germany, had modest (although significant) increases in blood pressure, significant increases in stress hormones, and a decline in quality of life (Evans *et al.* 1998). Children attending noisy schools had statistically significant average systolic and diastolic blood pressure ($p<0.03$). Systolic blood pressure means were 89.68 millimeters (mm) for children attending schools located in noisier environments compared to 86.77 mm for a control group. Similarly, diastolic blood pressure means for the noisier environment group were 47.84 mm and 45.16 mm for the control group (Cohen *et al.* 1980).

Although the literature appears limited, studies focused on the wide range of potential effects of aircraft noise on school children have also investigated hormonal levels between groups of children exposed to aircraft noise compared to those in a control group. Specifically, two studies analyzed cortisol and urinary catecholamine levels in school children as measurements of stress response to aircraft noise (Haines *et al.* 2001b and 2001c). In both instances, there were no differences between the aircraft-noise-exposed children and the control groups.

Other studies have reported hearing losses from exposure to aircraft noise. Noise-induced hearing loss was reportedly higher in children who attended a school located under a flight path near a Taiwan airport, as compared to children at another school far away (Chen *et al.* 1997). Another study reported that hearing ability was reduced significantly in individuals who lived near an airport and were frequently exposed to aircraft noise (Chen and Chen 1993). In that study, noise exposure near the airport was reportedly uniform, with DNL greater than 75 dB and maximum noise levels of about 87 dB during overflights. Conversely, several other studies that were reviewed reported no difference in hearing ability between children exposed to high levels of airport noise and children located in quieter areas (Fisch 1977, Andrus *et al.* 1975, Wu *et al.* 1995).

2.7 Effects on Domestic Animals and Wildlife

Hearing is critical to an animal's ability to react, compete, reproduce, hunt, forage, and survive in its environment. While the existing literature does include studies on possible effects of jet aircraft noise and sonic booms on wildlife, there appears to have been little concerted effort in developing quantitative comparisons of aircraft noise effects on normal auditory characteristics. Behavioral effects have been relatively well described, but the larger ecological context issues, and the potential for drawing conclusions regarding effects on populations, has not been well developed.

The relationships between potential auditory/physiological effects and species interactions with their environments are not well understood. Manci *et al.* (1988) assert that the consequences physiological effects may have on behavioral patterns is vital to understanding the long-term effects of noise on wildlife. Questions regarding the effects (if any) on predator-prey interactions, reproductive success, and intra-inter specific behavior patterns remain.

The following discussion provides an overview of the existing literature on noise effects (particularly jet aircraft noise) on animal species. The literature reviewed here involves those studies that have focused on the observations of the behavioral effects that jet aircraft have on animals.

A great deal of research was conducted in the 1960s and 1970s on the effects of aircraft noise on the public and the potential for adverse ecological impacts. These studies were largely completed in response to the increase in air travel and as a result of the introduction of supersonic jet aircraft. According to Manci *et al.* (1988), the foundation of information created from that focus does not necessarily correlate or provide information specific to the impacts to wildlife in areas overflown by aircraft at supersonic speed or at low altitudes.

The abilities to hear sounds and noise and to communicate assist wildlife in maintaining group cohesiveness and survivorship. Social species communicate by transmitting calls of warning, introduction, and other types that are subsequently related to an individual's or group's responsiveness.

Animal species differ greatly in their responses to noise. Noise effects on domestic animals and wildlife are classified as primary, secondary, and tertiary. Primary effects are direct, physiological changes to the auditory system, and most likely include the masking of auditory signals. Masking is defined as the inability of an individual to hear important environmental signals that may arise from mates, predators, or prey. There is some potential that noise could disrupt a species' ability to communicate or could interfere with behavioral patterns (Manci *et al.* 1988). Although the effects are likely temporal, aircraft noise may cause masking of auditory signals within exposed faunal communities. Animals rely on hearing to avoid predators, obtain food, and communicate with, and attract, other members of their species. Aircraft noise may mask or interfere with these functions. Other primary effects, such as ear drum rupture or temporary and permanent hearing threshold shifts, are not as likely given the subsonic noise levels produced by aircraft overflights. Secondary effects may include non-auditory effects such as stress and hypertension; behavioral modifications; interference with mating or reproduction; and impaired ability to obtain adequate food, cover, or water. Tertiary effects are the direct result of primary and secondary effects, and include population decline and habitat loss. Most of the effects of noise are mild enough that they may never be detectable as variables of change in population size or population growth against the background of normal variation (Bowles 1995). Other environmental variables (e.g., predators, weather, changing prey base, ground-based disturbance) also influence secondary and tertiary effects, and confound the ability to identify the ultimate factor in limiting productivity of a certain nest, area, or region (Smith *et al.* 1988). Overall, the literature suggests that species differ in their response to various types, durations, and sources of noise (Manci *et al.* 1988).

Many scientific studies have investigated the effects of aircraft noise on wildlife, and some have focused on wildlife "flight" due to noise. Apparently, animal responses to aircraft are influenced by many variables, including size, speed, proximity (both height above the ground and lateral distance), engine noise, color, flight profile, and radiated noise. The type of aircraft (e.g., fixed wing versus rotor-wing [helicopter]) and type of flight mission may also produce different levels of disturbance, with varying animal responses (Smith *et al.* 1988). Consequently, it is difficult to generalize animal responses to noise disturbances across species.

One result of the 1988 Manci *et al.*, literature review was the conclusion that, while behavioral observation studies were relatively limited, a general behavioral reaction in animals from exposure to aircraft noise is the startle response. The intensity and duration of the startle response appears to be dependent on which species is exposed, whether there is a group or an individual, and whether there have been some previous exposures. Responses range from flight, trampling, stampeding, jumping, or running, to movement of the head in the apparent direction of the noise source. Manci *et al.* (1988) reported that the literature indicated that avian species may be more sensitive to aircraft noise than mammals.

2.7.1 Domestic Animals

Although some studies report that the effects of aircraft noise on domestic animals is inconclusive, a majority of the literature reviewed indicates that domestic animals exhibit some behavioral responses to military overflights but generally seem to habituate to the disturbances over a period of time. Mammals in particular appear to react to noise at sound levels higher than 90 dB, with responses including the startle response, freezing (i.e., becoming temporarily stationary), and fleeing from the sound source. Many studies on domestic animals suggest that some species appear to acclimate to some forms of sound disturbance (Manci *et al.* 1988). Some studies have reported such primary and secondary effects as reduced milk production and rate of milk release, increased glucose concentrations, decreased levels of hemoglobin, increased heart rate, and a reduction in thyroid activity. These latter effects appear to represent a small percentage of the findings occurring in the existing literature.

Some reviewers have indicated that earlier studies, and claims by farmers linking adverse effects of aircraft noise on livestock, did not necessarily provide clear-cut evidence of cause and effect (Cottereau 1978). In contrast, many studies conclude that there is no evidence that aircraft overflights affect feed intake, growth, or production rates in domestic animals.

2.7.2 Summary

Some physiological/behavioral responses such as increased hormonal production, increased heart rate, and reduction in milk production have been described in a small percentage of studies. A majority of the studies focusing on these types of effects have reported short-term or no effects.

The literature does suggest that common responses include the "startle" or "fright" response and, ultimately, habituation. It has been reported that the intensities and durations of the startle response decrease with the numbers and frequencies of exposures, suggesting no long-term adverse effects. The majority of the literature suggests that domestic animal species (cows, horses, chickens) and wildlife species exhibit adaptation, acclimation, and habituation after repeated exposure to jet aircraft noise.

Animal responses to aircraft noise appear to be somewhat dependent on, or influenced by, the size, shape, speed, proximity (vertical and horizontal), engine noise, color, and flight profile of planes. Helicopters also appear to induce greater intensities and durations of disturbance behavior as compared to fixed-wing aircraft. Some studies showed that animals that had been previously exposed to jet aircraft noise exhibited greater degrees of alarm and disturbance to other objects creating noise, such as boats, people, and objects blowing across the landscape. Other factors influencing response to jet aircraft noise may include wind direction, speed, and local air turbulence; landscape structures (i.e., amount and type of vegetative cover); and, in the case of bird species, whether the animals are in the incubation/nesting phase.

2.8 Property Values

Property within a noise zone (or Accident Potential Zone) may be affected by the availability of federally guaranteed loans. According to U.S. Department of Housing and Urban Development (HUD), Federal Housing Administration (FHA), and Veterans Administration (VA) guidance, sites are acceptable for program assistance, subsidy, or insurance for housing in noise zones of less than 65 dB DNL, and sites are conditionally acceptable with special approvals and noise attenuation in the 65 to 75 dB DNL noise zone and the greater than 75 dB DNL noise zone. HUD's position is that noise is not the only determining factor for site acceptability, and properties should not be rejected only because of airport influences if there is evidence of acceptability within the market and if use of the dwelling is expected to continue. Similar to the Navy's and USAF's Air Installation Compatible Use Zone Program, HUD, FHA, and VA recommend sound attenuation for housing in the higher noise zones and written disclosures to all prospective buyers or lessees of property within a noise zone (or Accident Potential Zone).

Newman and Beattie (1985) reviewed the literature to assess the effect of aircraft noise on property values. One paper by Nelson (1978), reviewed by Newman and Beattie, suggested a 1.8 to 2.3 percent decrease in property value per decibel at three separate airports, while at another period of time, they found only a 0.8 percent devaluation per decibel change in DNL. However, Nelson also noted a decline in noise depreciation over time which he theorized could be due to either noise sensitive people being replaced by less sensitive people or the increase in commercial value of the property near airports; both ideas were supported by Crowley (1978). Ultimately, Newman and Beattie summarized that while an effect of noise was observed, noise is only one of the many factors that is part of a decision to move close to, or away from, an airport, but which is sometimes considered an advantage due to increased opportunities for employment or ready access to the airport itself.

More recently Fidell *et al.* (1996) studied the influences of aircraft noise on actual sale prices of residential properties in the vicinity of two military facilities and found that equations developed for one area to predict residential sale prices in areas unaffected by aircraft noise worked equally well when applied to predicting sale prices of homes in areas with aircraft noise in excess of 65 dB DNL. Thus, the model worked equally well in predicting sale prices in areas with and without aircraft noise exposure. This indicates that aircraft noise had no meaningful effect on residential property values. In some cases, the average sale prices of noise exposed properties were somewhat higher than those elsewhere in the same area. In the vicinity of Davis-Monthan Air Force Base (AFB) in Tucson, Arizona, Fidell found the homes near the AFB were much older, smaller, and in poorer condition than homes elsewhere. These factors caused the equations developed for predicting sale prices in areas further away from the base to be inapplicable with those nearer the AFB. However, again Fidell found that, similar to other researchers, differences in sale prices between homes with and without aircraft noise were frequently due to factors other than noise itself.

2.8.1 Noise Effects on Structures

Normally, the most sensitive components of a structure to airborne noise are the windows and, infrequently, the plastered walls and ceilings. An evaluation of the peak sound pressures impinging on the structure is normally used to determine the possibility of damage. In general, with peak sound levels above 130 dB, there is the possibility of the excitation of structural component resonances. While certain frequencies (such as 30 Hz for window breakage) may be of more concern than other frequencies, conservatively, only sounds lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (CHABA 1977).

Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations, or rattling of objects within the dwelling such as hanging pictures, dishes, plaques, and bric-a-brac. Window panes may also vibrate noticeably when exposed to high levels of airborne noise. In general, such noise- induced vibrations occur at peak sound levels of 110 dB or greater. Thus, assessments of noise exposure levels for compatible land use should also be protective of noise-induced secondary vibrations.

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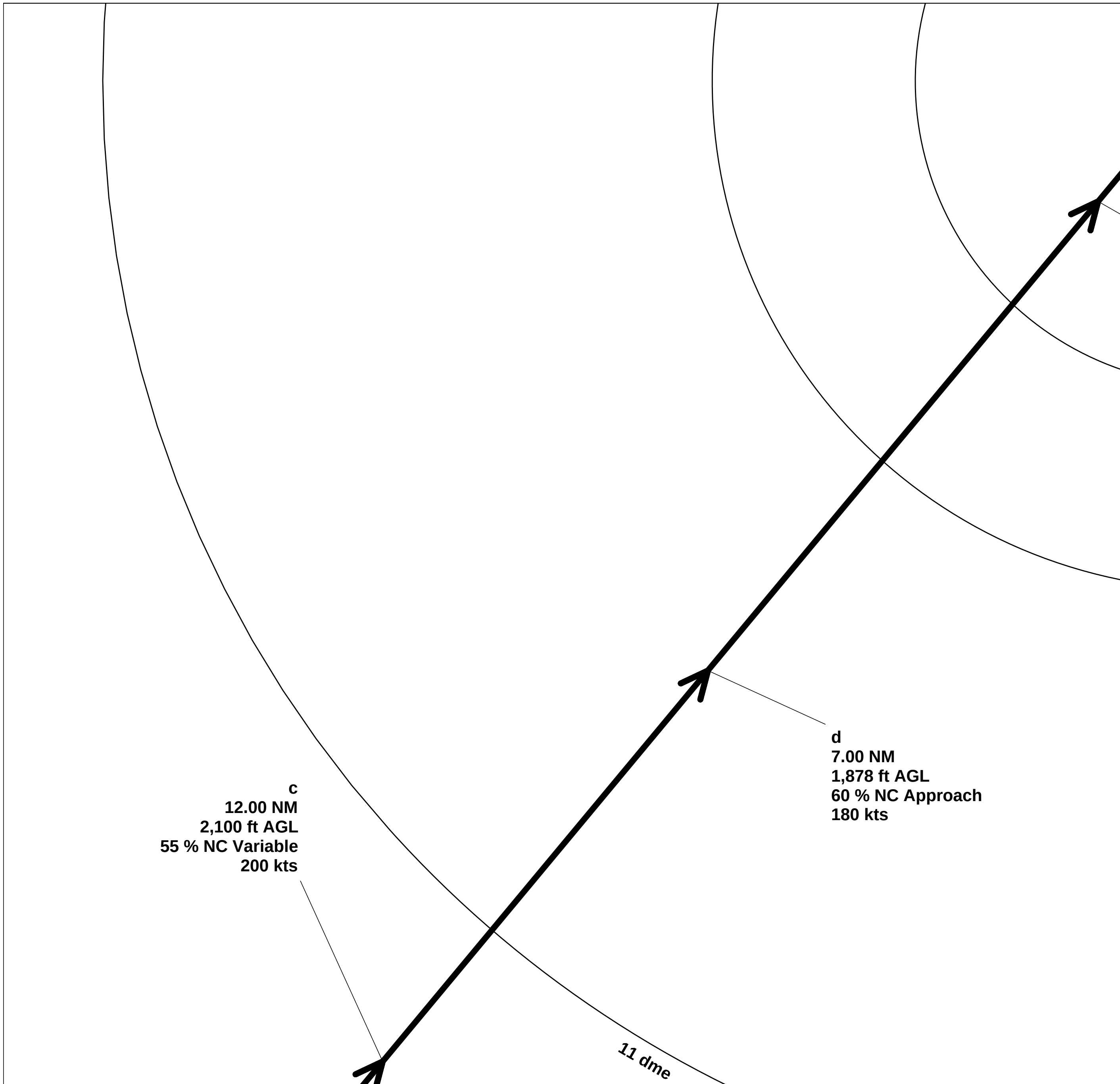
Noise Modeling Input Data, Sample for KC-135 and KC-46A

Example Flight Profiles



Flight Profile KC 135 AA

Point	Distance NM	Height ft	Power % NC	Speed kts
a	32.92	10,000 AGL	55 Variable	250
b	25.00	10,000 AGL	55 Variable	200
c	12.00	2,100 AGL	55 Variable	200
d	7.00	1,878 AGL	60 Approach	180
e	1.00	500 AGL	60 Approach	140
f	0.00	50 AGL	60 Approach	140

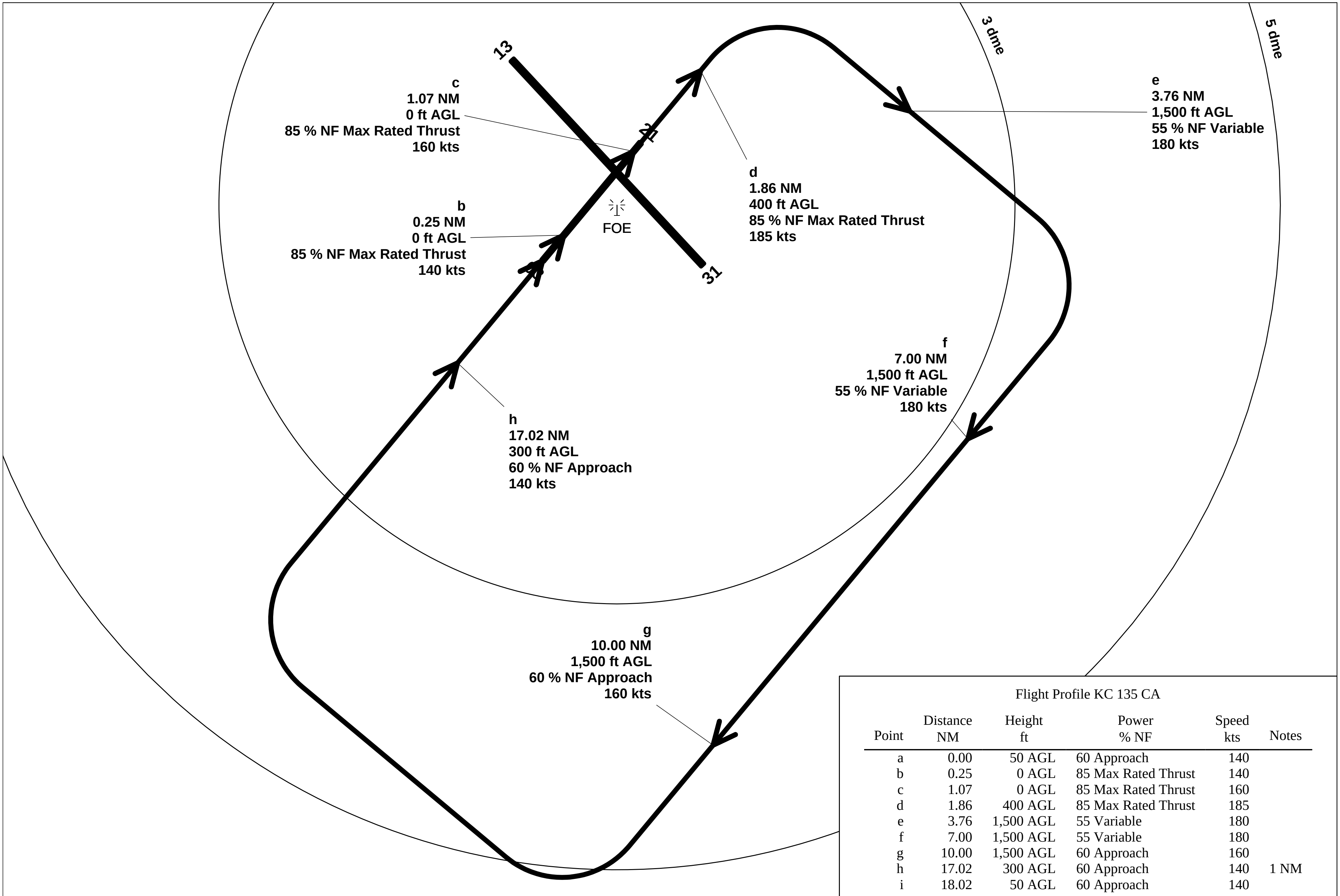
Flight Profile KC 135 AA

ST-IN FROM SOUTHWEST

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000

Scale in Feet 1:109,000 (1 inch = 9,100 feet)

N

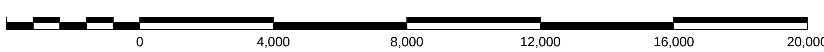


Flight Profile KC 135 CA

Point	Distance NM	Height ft	Power % NF	Speed kts	Notes
a	0.00	50 AGL	60 Approach	140	
b	0.25	0 AGL	85 Max Rated Thrust	140	
c	1.07	0 AGL	85 Max Rated Thrust	160	
d	1.86	400 AGL	85 Max Rated Thrust	185	
e	3.76	1,500 AGL	55 Variable	180	
f	7.00	1,500 AGL	55 Variable	180	
g	10.00	1,500 AGL	60 Approach	160	
h	17.02	300 AGL	60 Approach	140	1 NM
i	18.02	50 AGL	60 Approach	140	

Flight Profile KC 135 CA

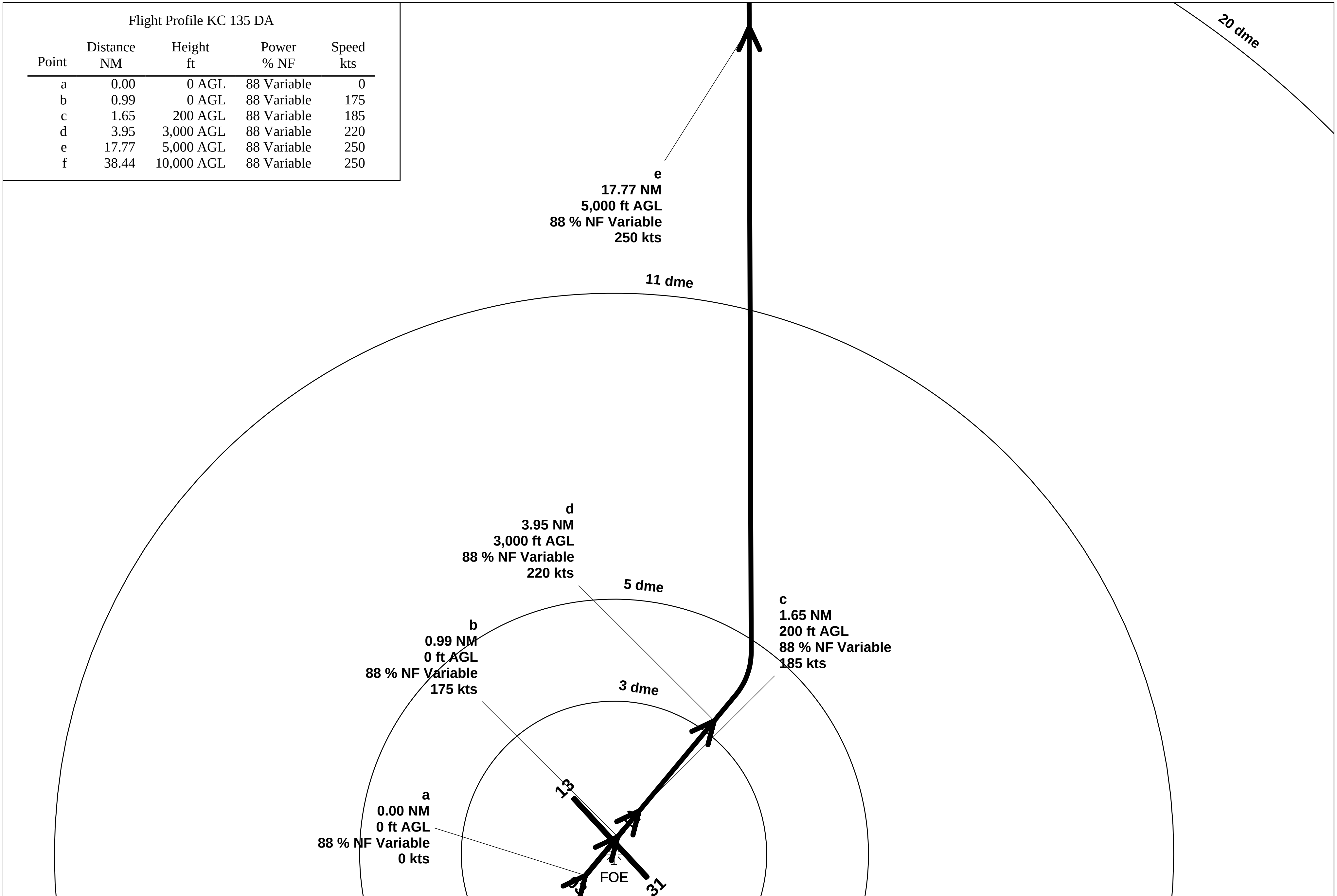
VFR RIGHT TURNS SOUTH SIDE, (TANKER AND LARGE AIRCRAFT)



Scale in Feet 1:69,100 (1 inch = 5,760 feet)

Flight Profile KC 135 DA

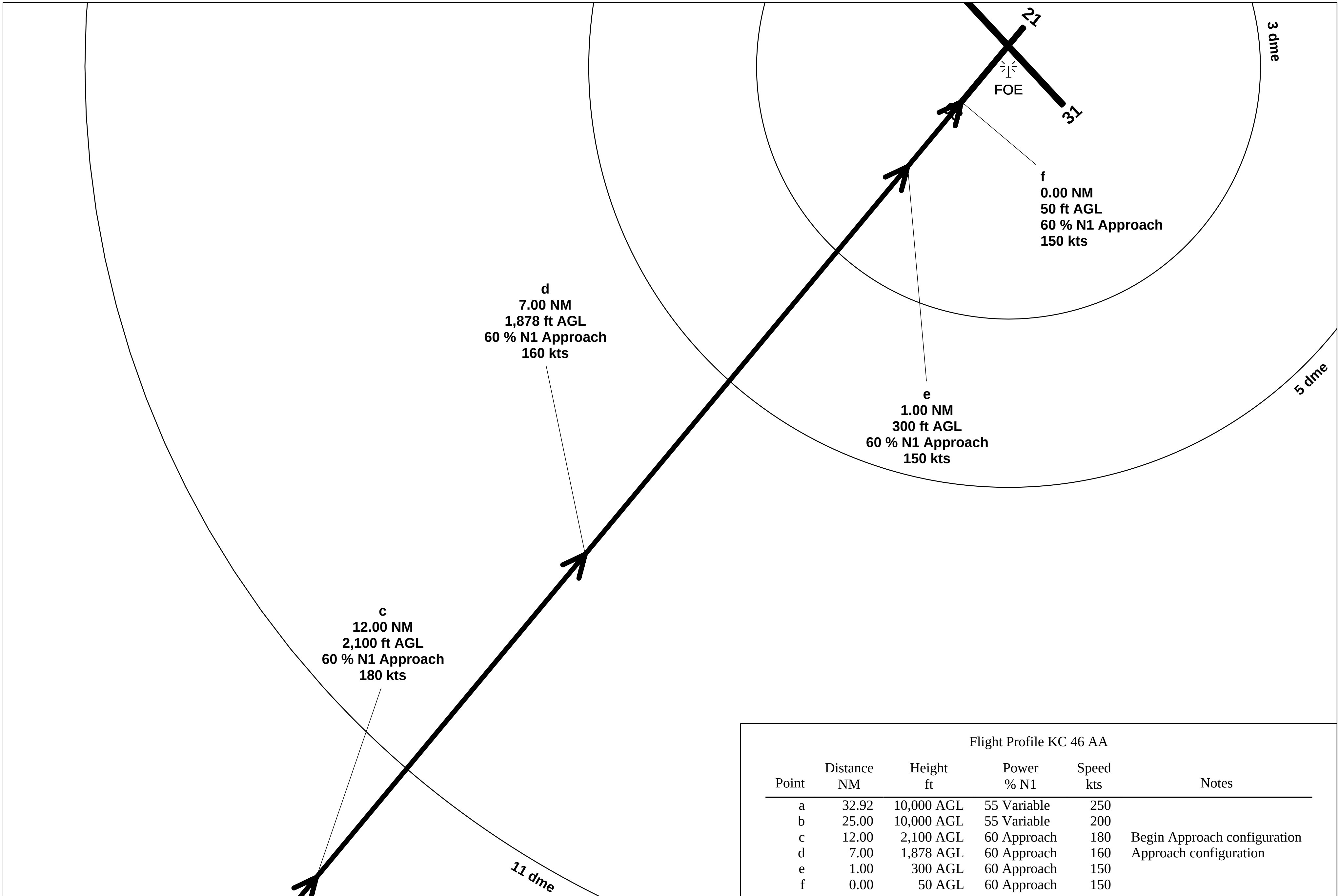
Point	Distance NM	Height ft	Power % NF	Speed kts
a	0.00	0 AGL	88 Variable	0
b	0.99	0 AGL	88 Variable	175
c	1.65	200 AGL	88 Variable	185
d	3.95	3,000 AGL	88 Variable	220
e	17.77	5,000 AGL	88 Variable	250
f	38.44	10,000 AGL	88 Variable	250



Flight Profile KC 135 DA

LEFT TURN TO NORTH

Scale in Feet 1:180,000 (1 inch = 15,000 feet)



Flight Profile KC 46 AA

Point	Distance NM	Height ft	Power % N1	Speed kts	Notes
a	32.92	10,000 AGL	55 Variable	250	
b	25.00	10,000 AGL	55 Variable	200	
c	12.00	2,100 AGL	60 Approach	180	Begin Approach configuration
d	7.00	1,878 AGL	60 Approach	160	Approach configuration
e	1.00	300 AGL	60 Approach	150	
f	0.00	50 AGL	60 Approach	150	

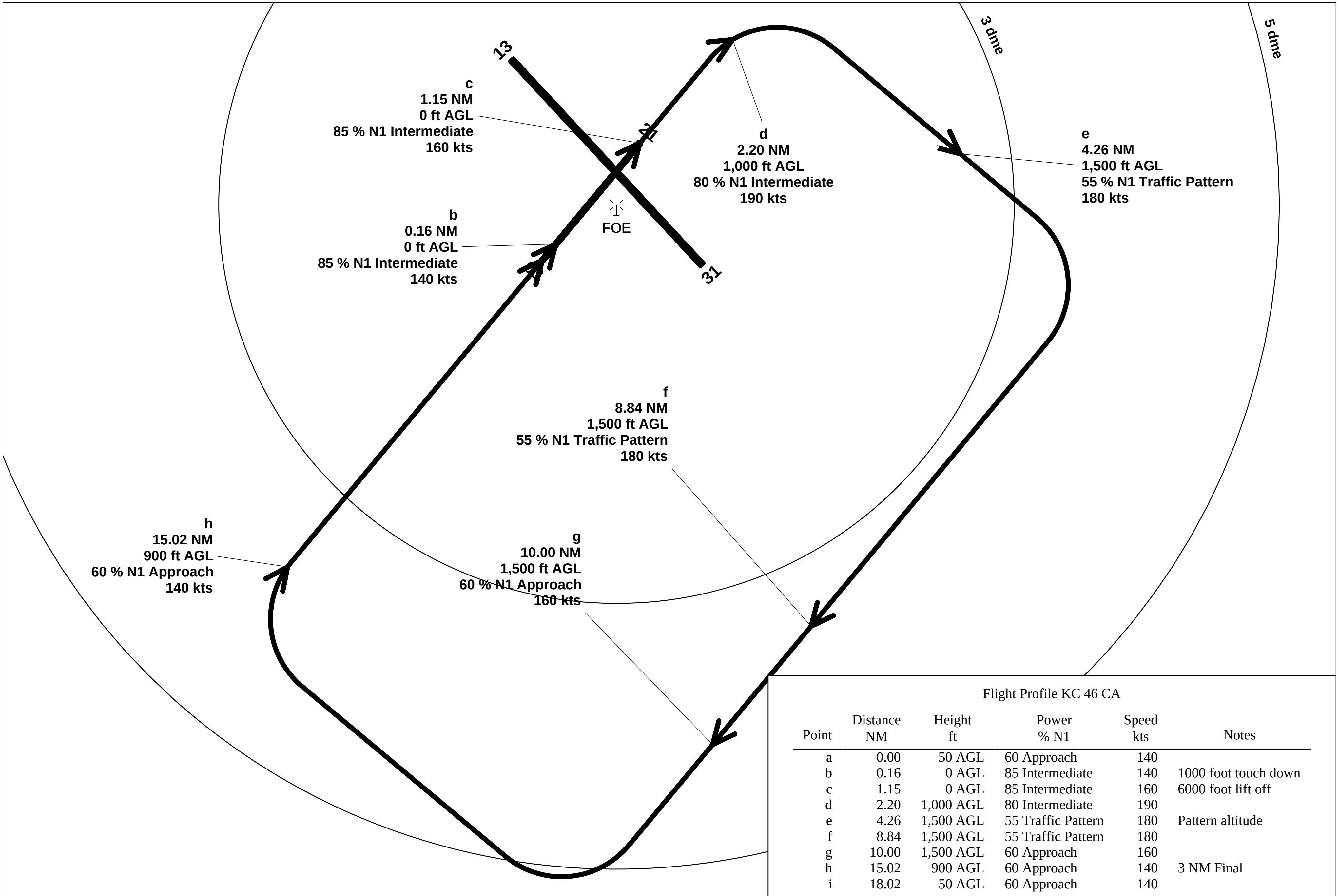
Flight Profile KC 46 AA

ST-IN FROM SOUTHWEST

0 4,000 8,000 12,000 16,000 20,000 24,000 28,000 32,000 36,000

Scale in Feet 1:109,000 (1 inch = 9,100 feet)

N

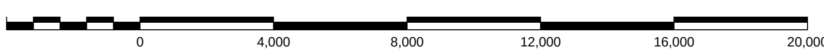


Flight Profile KC 46 CA

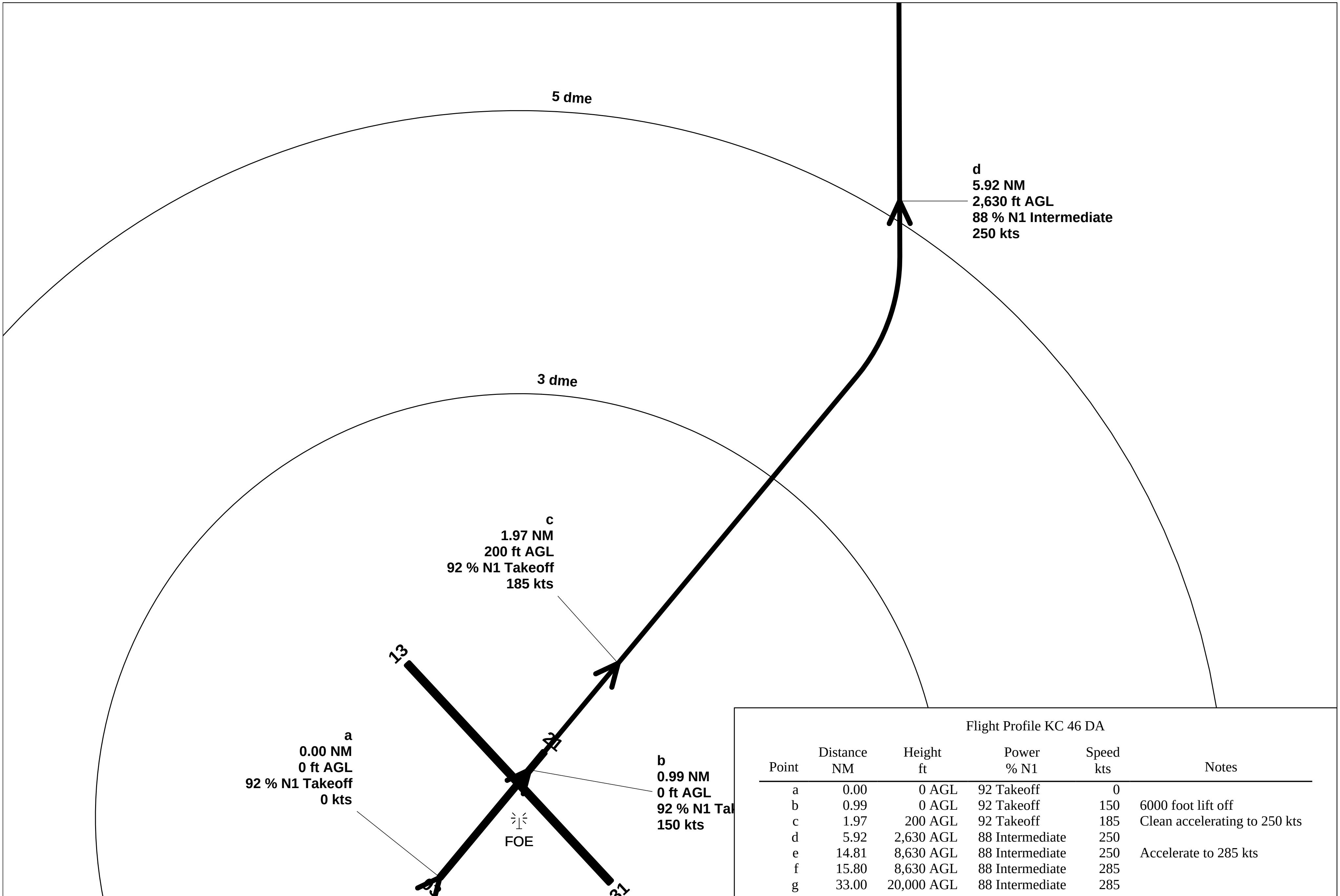
Point	Distance NM	Height ft	Power % N1	Speed kts	Notes
a	0.00	50 AGL	60 Approach	140	
b	0.16	0 AGL	85 Intermediate	140	1000 foot touch down
c	1.15	0 AGL	85 Intermediate	160	6000 foot lift off
d	2.20	1,000 AGL	80 Intermediate	190	
e	4.26	1,500 AGL	55 Traffic Pattern	180	Pattern altitude
f	8.84	1,500 AGL	55 Traffic Pattern	180	
g	10.00	1,500 AGL	60 Approach	160	
h	15.02	900 AGL	60 Approach	140	3 NM Final
i	18.02	50 AGL	60 Approach	140	

Flight Profile KC 46 CA

VFR RIGHT TURNS SOUTH SIDE, (TANKER AND LARGE AIRCRAFT)



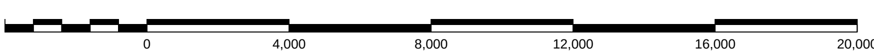
Scale in Feet 1:69,100 (1 inch = 5,760 feet)



Flight Profile KC 46 DA

Point	Distance NM	Height ft	Power % N1	Speed kts	Notes
a	0.00	0 AGL	92 Takeoff	0	
b	0.99	0 AGL	92 Takeoff	150	6000 foot lift off
c	1.97	200 AGL	92 Takeoff	185	Clean accelerating to 250 kts
d	5.92	2,630 AGL	88 Intermediate	250	
e	14.81	8,630 AGL	88 Intermediate	250	Accelerate to 285 kts
f	15.80	8,630 AGL	88 Intermediate	285	
g	33.00	20,000 AGL	88 Intermediate	285	

Flight Profile KC 46 DA
LEFT TURN TO NORTH



Scale in Feet 1:65,000 (1 inch = 5,410 feet)

Appendix D

Air Quality

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APPENDIX D AIR QUALITY

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Appendix D1

Air Quality Background Information

APPENDIX D1 AIR QUALITY BACKGROUND INFORMATION

This appendix provides assumptions used to calculate emissions for the Proposed Action alternatives, as well as tables showing the emission calculations. Emissions from these categories of sources were calculated based on guidance from the United States Air Force (USAF) in their *Air Emissions Guide for Air Force Mobile Sources – Methods for Estimating Emissions of Air Pollutants for Mobile Sources at U.S. Air Force Installations* (Air Force Civil Engineer Center [AFCEC] 2013), utilizing the latest air emissions modeling tools. Each category of emissions is discussed in the sections below.

1.0 Construction Assumptions

It was assumed that each construction project associated with the Proposed Action would be constructed in a single year, and that all construction would occur in Fiscal Year (FY) 2015. Factors needed to derive construction source emission rates were obtained from the *Compilation of Air Pollutant Emission Factors*, AP-42, Volume I (United States Environmental Protection Agency [USEPA] 1995), the USEPA NONROAD2008a model for nonroad construction equipment (USEPA 2009), and the USEPA MOVES2010b model for on-road vehicles (USEPA 2013b).

Operational emissions from sources operating in association with the Proposed Action include aircraft operations, aerospace ground equipment (AGE), engine testing, and personal vehicle use. Calculation methodologies for each emission category and assumptions used to calculate emissions for the Proposed Action alternatives are discussed below.

2.0 Aircraft Operations

The methodology for estimating aircraft emissions involves evaluating the type of operations for each type of aircraft, the number of hours of operation for each aircraft type, the type of engine in each aircraft, and the mode of operation for each type of aircraft engine. Aircraft emissions are calculated based on the type of aircraft, the engine model, the operational mode and time-in-mode (TIM) for each mode, the power setting associated with each operational mode, the fuel flow rate associated with each power setting, engine-specific emission factors, the mixing zone height, and the number of landing-takeoff (LTO) cycles conducted during the course of a year. As TIM and fuel flow for each power setting varies among aircraft engines and airframes, the calculation procedure was repeated for individual aircraft types.

The types of aircraft and numbers and type of operations were obtained from the installations for both existing conditions (KC-135 aircraft) and Proposed Action alternatives (KC-46A aircraft). The operational profiles from the noise modeling analysis conducted for the Proposed Action were used to calculate emissions, accounting for the mode of operation for aircraft engines, engine speed, and elevation above ground level.

As discussed in the USAF guidance document, because estimating emissions using an LTO approach accounts for exhaust emissions associated with aircraft operations occurring both on the ground and up to the mixing zone height, the choice of a mixing zone height will have a direct impact on total emissions. Mixing zone height is used to adjust the TIM during the approach and climb out modes of an LTO when calculating emissions. Thus a shallow mixing zone height will result in a shorter TIM (and fewer emissions), and a high mixing zone height will result in a longer TIM (and more emissions). While emissions occurring anywhere within this zone will impact ground-level pollutant concentrations, emissions occurring above it will generally not be mixed to the ground. Because atmospheric stability (and hence inversions) are a function of temperature, mixing zone height varies depending on location, hour, and season, and is affected by local topography, time of day, and time of year. USEPA guidance notes that in most instances where oxides of nitrogen (NO_x) emissions are not a local air quality concern, a default mixing zone height of 3,000 feet can be used. If, however, NO_x emissions are considered an important component of the emission inventory, specific mixing height data must be gathered and used. The Federal Aviation Administration (FAA) has adopted this USEPA default value in its recommended procedures. For purposes of maximizing the accuracy of the inventory, location specific climate and meteorological data should be used where available to determine seasonal or annual average mixing height.

For conservative purposes, the mixing height was assumed to be 3,000 feet above ground level (AGL).

Emissions were calculated for individual flight operations as follows:

Emissions = TIM/60 x FFR/1000 x EI x NE x N

Where,

TIM = Time spent in each mode (min/cycle)

60 = Factor for converting minutes into hours

FFR = Fuel flow rate per engine (lb/hr)

1000 = Factor for converting lb/hr to 1000 lb/hr

EI = Emission factor (lb/1000 lb)

NE = Number of engines/aircraft

N = number of operations

The KC-135 aircraft are equipped with four engines, and the KC-46A aircraft are equipped with two engines. Based on the flight profiles for the two aircraft provided for the noise analysis, training flight profiles would have the same TIM and same profiles.

Emission calculations for the baseline condition and Proposed Action alternatives are provided in this appendix.

3.0 Aircraft Ground Equipment

AGE includes onsite mobile support equipment such as tow tractors, reciprocating engines, and gas turbines used to support aircraft operations. Based on information from the *Air Emissions Guide for Air Force Mobile Sources – Methods for Estimating Emissions of Air Pollutants for Mobile Sources at U.S. Air Force Installations* (AFCEC 2013), emissions for AGE were calculated assuming AGE usage rates per LTO from the *Air Emissions Factor Guide*.

Emission estimates for AGE are provided in this appendix.

4.0 Engine Testing

Baseline emissions from on-wing engine testing were obtained from the operations shown in the Static Pad Summary. It was assumed that the number of engines tested annually would be proportional to the number of aircraft operations at each installation. Engine testing was calculated for the KC-135 engines for baseline conditions and for the KC-46A engines based on similar testing profiles, adjusting for the number of aircraft operations at the installation.

Emission estimates are provided in this appendix.

5.0 Ground Vehicles

Emissions from ground vehicles were calculated using emission factors from the *Air Emissions Guide for Air Force Mobile Sources – Methods for Estimating Emissions of Air Pollutants for Mobile Sources at U.S. Air Force Installations* (AFCEC 2013). Ground vehicles operations associated with the baseline and Proposed Action alternatives were calculated based on estimates of personnel that would be associated with the Proposed Action at each installation. It was assumed that vehicles would travel 1 mile on base. The distance traveled off base was estimated based on the distance from the installation to the nearest population center (i.e., downtown metropolitan area). Emission estimates include emissions from startups, hot soak, diurnal evaporative emissions, resting loss, and running loss, as well as running exhaust emissions in grams per mile. Emission estimates are provided in this appendix.

6.0 References

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______. 2009. NONROAD 2008a Model. http://www.epa.gov/otaq/nonrdmdl.html.

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Appendix D2

Conformity Applicability

APPENDIX D2 CONFORMITY APPLICABILITY ANALYSIS

This appendix presents the Clean Air Act (CAA) General Conformity Applicability Analysis for the KC-46A Beddown at Alternative Air National Guard (ANG) Installations.

1.0 BACKGROUND

The 1990 CAA Amendments revised Section 176(c) to, among other things, require the U.S. Environmental Protection Agency (USEPA) to promulgate regulations establishing the criteria and procedures for determining conformity of federal actions to the applicable State Implementation Plan (SIP) or Federal Implementation Plan. General conformity to a SIP or Federal Implementation Plan means that a Federal agency's activities will not produce new air quality violations, worsen existing violations, or delay an area's timely attainment of the National Ambient Air Quality Standards (NAAQS). On November 30, 1993, the USEPA promulgated regulations, entitled *Determining Conformity of General Federal Actions to State or Federal Implementation Plans*, that were codified at 40 Code of Federal Regulations (CFR) Part 51 Subpart W and at 40 CFR Part 93 Subpart B. The regulations at 40 CFR Part 93 were interim regulations until states amended their SIPs per the regulations in 40 CFR Part 51. In 1995, Congress added subparagraph (5) to CAA Section 176(c), limiting the section's applicability to areas designated either nonattainment or maintenance.

2.0 REGULATORY REQUIREMENTS

Under the provisions of 40 CFR Parts 51 and 93, Federal actions are required to conform with the approved SIP for those areas that are categorized as nonattainment or maintenance areas for any criteria pollutant. The purpose of the General Conformity Rule is to demonstrate that the Proposed Action will not cause or contribute to a violation of an air quality standard, and that the project will not adversely affect the air basin's ability to attain and maintain the ambient air quality standards.

The first step in the evaluation is to determine whether the project's emissions of nonattainment pollutants or precursors would exceed the regulatory *de minimis* thresholds established in 40 CFR 93. The following sections discuss the attainment status and General Conformity Rule requirements for each of the alternative ANG installations.

2.1 190th Air Refueling Wing

Forbes Air National Guard Station (ANGS), home of the 190th Air Refueling Wing (190 ARW) of the Kansas Air National Guard (KS ANG), is located on Forbes Field Airport, approximately 5 miles south of Topeka in Shawnee County, Kansas. The USEPA has classified the state of

Kansas as an attainment/unclassified area for all criteria pollutants. The Proposed Action is therefore not subject to the requirements of Section 176(c) of the CAA, as articulated in the USEPA General Conformity Rule.

2.2 108th Wing

Joint Base McGuire-Dix-Lakehurst (JB MDL) is located in the central portion of the state of New Jersey, in Ocean and Burlington counties. The USEPA has classified the Philadelphia-Wilmington-Atlantic City area of the states of Pennsylvania, Delaware, and New Jersey as nonattainment for the ozone (O_3) (marginal nonattainment) and particulate matter less than or equal to 2.5 microns in diameter ($PM_{2.5}$) NAAQS, and a maintenance area for carbon dioxide (CO). The region is designated attainment/unclassified area for all other criteria pollutants. The proposed action is therefore subject to the requirements of Section 176(c) of the CAA, as articulated in the USEPA General Conformity Rule. Based on the nonattainment classification for the region, the *de minimis* emission thresholds for the General Conformity Rule for O_3 precursors (oxides of nitrogen [NO_x] and volatile organic compounds [VOCs]) is 100 tons per year (tpy), and the *de minimis* emission thresholds for $PM_{2.5}$ and CO emissions are also 100 tpy.

2.3 157th Air Refueling Wing

Pease ANGS, home of the 157th Air Refueling Wing (157 ARW) of the New Hampshire Air National Guard (NH ANG), is located in Newington, New Hampshire approximately 1 mile west of Portsmouth, New Hampshire. The USEPA had previously classified the Boston-Manchester-Portsmouth area as a moderate nonattainment area for the 1997 O_3 standard. On January 31, 2013, the USEPA formally redesignated southeastern New Hampshire as an attainment area for the 1997 O_3 standard. The region is therefore considered a maintenance area for O_3. The region is designated attainment/unclassified area for all other criteria pollutants. The proposed action is therefore subject to the requirements of Section 176(c) of the CAA, as articulated in the USEPA General Conformity Rule. Based on the classification for the region as a maintenance area, the *de minimis* emission thresholds for the General Conformity Rule for O_3 precursors (NO_x and VOCs) is 100 tpy.

2.4 171st Air Refueling Wing

The USEPA has classified Allegheny County as a moderate nonattainment area for the O_3 NAAQS, and a nonattainment area for $PM_{2.5}$. Pittsburgh is also designated as a nonattainment area for CO, but this designation applies only in high traffic areas in the central business district of the city. The region is designated attainment/unclassified area for all other criteria pollutants. Alternative #4 is therefore subject to the requirements of Section 176(c) of the CAA, as articulated in the USEPA General Conformity Rule. Based on the nonattainment classification for the region, the *de minimis* emission thresholds for the General Conformity Rule for O_3

precursors (NO_x and VOCs) is 100 tpy, and the *de minimis* emission threshold for $PM_{2.5}$ emissions is also 100 tpy.

2.5 121st Air Refueling Wing

Rickenbacker ANGS is located approximately 12 miles south of downtown Columbus, Ohio in Franklin County. The USEPA has classified the Columbus area, including all of Franklin County, as nonattainment for the O_3 and $PM_{2.5}$ NAAQS. The region is designated attainment/unclassified area for all other criteria pollutants. The proposed action is therefore subject to the requirements of Section 176(c) of the CAA, as articulated in the USEPA General Conformity Rule. Based on the nonattainment classification for the region, the *de minimis* emission thresholds for the General Conformity Rule for O_3 precursors (NO_x and VOCs) is 100 tpy, and the *de minimis* emission threshold for $PM_{2.5}$ emissions is also 100 tpy.

Table 2.5-1 summarizes the *de minimis* emission thresholds for the alternatives.

Table 2.5-1. General Conformity *De Minimis* Thresholds, tons per year

Installation	*VOCs*	*NO_x*	*CO*	*SO_2*	*PM_{10}*	*$PM_{2.5}$*
190 ARW – Forbes	NA	NA	NA	NA	NA	NA
108 WG – JBMDL	100	100	100	NA	NA	100
157 ARW – Pease	100	100	NA	NA	NA	NA
171 ARW – Pittsburgh	100	100	NA	NA	NA	100
121 ARW - Rickenbacker	100	100	NA	NA	NA	100

Notes: NA – *de minimis* threshold not applicable – installation is in attainment/unclassified area for this pollutant.
VOC = volatile organic compound; NO_x = oxides of nitrogen; CO = carbon dioxide; SO_2 = sulfur dioxide; PM10 = particulate matter less than or equal to 10 microns in diameter; PM2.5 = particulate matter less than or equal to 2.5 microns in diameter; 190 ARW = 190th Air Refueling Wing; 108 WG = 108th Wing; 157 ARW = 157th Air Refueling Wing; 171 ARW = 171st Air Refueling Wing; 121 ARW = 121st Air Refueling Wing

3.0 EMISSIONS ASSOCIATED WITH THE FEDERAL ACTION

This section of the Conformity Applicability Analysis presents estimates of emissions associated with the proposed alternatives, and an evaluation of the applicability of the General Conformity Rule to the proposed alternatives.

3.1 190th Air Refueling Wing

Because the 190 ARW is not subject to the General Conformity Rule, the rule is not applicable and no further analysis is required.

3.2 108th Wing

The emissions associated with the proposed action at JBMDL include construction emissions and operational emissions. Construction emissions are summarized in Table 3.2-1. As shown in Table 3.2-1, emissions would be below the *de minimis* thresholds for all pollutants.

Table 3.2-1. Annual Construction Emissions under Alternative #2 – 108 WG Installation

Construction Project	ANNUAL EMISSIONS, TONS/YEAR			
	CO	*NO_x*	*VOC*	*$PM_{2.5}$*
Total Construction Emissions	**8.01**	**16.11**	**2.08**	**7.23**
***de minimis* Threshold**	**100**	**100**	**100**	**100**

Table 3.2-2 presents the net annual operational emissions increase (decrease) associated with the beddown of the KC-46A aircraft at JB MDL. As shown in Table 3.2-2, emissions are below the *de minimis* thresholds for all pollutants except NO_x. Emissions of NO_x would exceed the *de minimis* threshold, and this alternative would therefore require a Conformity Determination under the General Conformity Rule.

Table 3.2-2. Comparison of Baseline and Proposed Annual Operational Emissions, 108 WG

Baseline	ANNUAL EMISSIONS, TONS/YEAR			
	VOC	*CO*	*NO_x*	*$PM_{2.5}$*
Aircraft Operations	3.21	49.03	83.34	0.39
AGE	0.01	0.01	0.09	0.00
Engine Tests	0.14	2.01	0.55	0.01
POVs	5.12	110.72	5.20	0.12
Total	**8.48**	**161.78**	**89.18**	**0.53**
Proposed Action	*VOC*	*CO*	*NO_x*	*$PM_{2.5}$*
Aircraft Operations	26.19	100.37	294.03	0.96
AGE	0.01	0.02	0.17	0.01
Engine Tests	1.53	5.23	1.38	0.01
POVs	4.75	126.34	3.97	0.12
Total	**32.48**	**231.97**	**299.54**	**1.11**
Net Increase	**24.01**	**70.19**	**210.36**	**0.58**
***de minimis* Threshold**	**100**	**100**	**100**	**100**

Notes: Numbers may not add precisely due to rounding
CO = carbon monoxide; NO_x = oxides of nitrogen; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; VOC = volatile organic compound

3.3 157th Air Refueling Wing

The emissions associated with the proposed action at Pease ANGS include construction emissions and operational emissions. Construction emissions are summarized in Table 3.3-1. As shown in Table 3.3-1, emissions would be below the *de minimis* thresholds for all pollutants.

Table 3.3-1. Annual Construction Emissions under Alternative #3 – 157 ARW Installation

Construction Project	Annual Emissions, tons/year	
	NO_x	*VOC*
Total Construction Emissions	**10.99**	**1.64**
***de minimis* Threshold**	**100**	**100**

Table 3.3-2 presents the net annual operational emissions increase (decrease) associated with the beddown of the KC-46A aircraft at Pease ANGS. As shown in Table 3.3-2, emissions would be below the *de minimis* thresholds for all pollutants. This alternative would therefore not be subject to the requirements of the General Conformity Rule for a Conformity Determination, and a Record of Non-Applicability would be prepared for this alternative.

Table 3.3-2. Comparison of Baseline and Proposed Annual Operational Emissions, 157 ARW

Baseline	Annual Emissions, tons/year	
	VOC	*NO_x*
Aircraft Operations	2.41	73.94
AGE	0.00	0.07
Engine Tests	0.10	0.40
POVs	1.11	0.91
Total	**3.62**	**75.32**
Proposed Action	*VOC*	*NO_x*
Aircraft Operations	15.24	157.41
AGE	0.01	0.10
Engine Tests	0.77	0.71
POVs	0.91	0.70
Total	**16.93**	**158.92**
Net Increase	**13.31**	**83.60**
***de minimis* Threshold**	**100**	**100**

Notes: Numbers may not add precisely due to rounding
NO_x = oxides of nitrogen; VOC = volatile organic compound

3.4 171st Air Refueling Wing

The emissions associated with the proposed action at Pittsburgh ANGS include construction emissions and operational emissions. Construction emissions are summarized in Table 3.4-1. As shown in Table 3.4-1, emissions would be below the *de minimis* thresholds for all pollutants.

Table 3.4-1. Annual Construction Emissions under Alternative #4 – 171 ARW Installation

Construction Project	Annual Emissions, tons/year		
	NO_x	*VOC*	*$PM_{2.5}$*
Total Construction Emissions	**14.68**	**1.91**	**6.60**
***de minimis* Threshold**	**100**	**100**	**100**

Table 3.4-2 presents the net annual operational emissions increase (decrease) associated with the beddown of the KC-46A aircraft at Pittsburgh International Airport (IAP). As shown in Table 3.4-2, emissions are below the *de minimis* thresholds for all pollutants. This alternative would

therefore not be subject to the requirements of the General Conformity Rule for a Conformity Determination, and a Record of Non-Applicability would be prepared for this alternative.

Table 3.4-2. Comparison of Baseline and Proposed Annual Operational Emissions, 171 ARW

	Annual Emissions, tons/year		
Baseline	***VOC***	***NO_x***	***$PM_{2.5}$***
Aircraft Operations	3.42	67.79	0.33
AGE	0.01	0.10	0.00
Engine Tests	0.11	0.46	0.01
POVs	4.27	3.37	0.06
Total	**7.81**	**71.72**	**0.40**
Proposed Action	***VOC***	***NO_x***	***$PM_{2.5}$***
Aircraft Operations	20.22	158.42	0.56
AGE	0.01	0.13	0.01
Engine Tests	0.80	0.74	0.01
POVs	3.44	2.52	0.06
Total	**24.48**	**161.81**	**0.64**
Net Increase	**16.67**	**90.09**	**0.24**
***de minimis* Threshold**	**100**	**100**	**100**

Notes: Numbers may not add precisely due to rounding
NO_x = oxides of nitrogen; $PM_{2.5}$ = particulate matter less than or equal to 2.5 microns in diameter; VOC = volatile organic compound

3.5 121st Air Refueling Wing

The emissions associated with the proposed action at Rickenbacker ANGS include construction emissions and operational emissions. Construction emissions are summarized in Table 3.5-1. As shown in Table 3.5-1, emissions would be below the *de minimis* thresholds for all pollutants.

Table 3.5-1. Annual Construction Emissions under Alternative #5 – 121 ARW Installation

Construction Project	***NO_x***	***VOC***
Total Construction Emissions	**24.82**	**2.80**
***de minimis* Threshold**	**100**	**100**

Table 3.5-2 presents the net annual operational emissions increase (decrease) associated with the beddown of the KC-46A aircraft at Rickenbacker ANGS. As shown in Table 3.5-2, emissions are below the *de minimis* thresholds for all pollutants. This alternative would therefore not be subject to the requirements of the General Conformity Rule for a Conformity Determination, and a Record of Non-Applicability would be prepared for this alternative.

Table 3.5-2. Comparison of Baseline and Proposed Annual Operational Emissions, 121 ARW

	Annual Emissions, tons/year	
Baseline	***VOC***	***NO_x***
Aircraft Operations	4.63	64.35
AGE	0.01	0.15
Engine Tests	0.11	0.43
POVs	4.55	3.55
Total	**9.29**	**68.48**
Proposed Action	***VOC***	***NO_x***
Aircraft Operations	21.71	123.58
AGE	0.01	0.15
Engine Tests	0.59	0.54
POVs	4.09	2.68
Total	**26.43**	**126.95**
Net Increase	**17.13**	**58.47**
***de minimis* Threshold**	**100**	**100**

Notes: Numbers may not add precisely due to rounding
NO_x = oxides of nitrogen; VOC = volatile organic compound

In accordance with the requirements of the General Conformity Rule, a conformity determination is required for each pollutant where the total of direct and indirect emissions associated with the federal action would equal or exceed any of the *de minimis* thresholds. Should Alternative #2 be chosen as the Proposed Action, the ANG would be required to make a determination as to the conformity of emissions of NO_x with the O_3 SIP for the air basin in which the Proposed Action occurs.

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Appendix D3

Emission Calculations

Table D3.1-1. Engine Emission Factors by Throttle Setting - KC-135 and KC-46A Aircraft

Engine Type/Throttle Setting	Fuel Flow (Pounds/Hour)	Emission Factors, lbs/1000 lbs fuel								
		VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
F-108-CF-100 (2)										
Idle (9%)	1013.76	2.1045	30.7	4	1.06	0.06	0.06	3216	8.90E-02	1.00E-01
Approach (30%)	2463.12	0.092	4.2	8.2	1.06	0.06	0.06	3216	8.90E-02	1.00E-01
Intermediate (70%)	6486.48	0.0575	0.09	16	1.06	0.05	0.05	3216	8.90E-02	1.00E-01
Military (78%)	7801.2	0.046	0.09	18.5	1.06	0.07	0.07	3216	8.90E-02	1.00E-01
P&W 4062 (3)										
Idle (7%)	1,663	12.49	42.61	3.78	1.06	0.11	0.10	3,216	0.09	0.10
Approach (30%)	5,702	0.10	1.93	12.17	1.06	0.05	0.04	3,216	0.09	0.10
Climbout (80%)	16,870	0.08	0.50	25.98	1.06	0.07	0.06	3,216	0.09	0.10
Take-Off (100%)	21,622	0.09	0.61	34.36	1.06	0.08	0.07	3,216	0.09	0.10
		Emissions, Pounds/Hour								
APU Use - P&W 4062		0.04	0.33	6.72	0.56	0.05	0.04	1373		

Notes: (1) Data are for one engine. The KC-135 has 4 engines and the KC-46A has 2 engines.

(2) Data from *Air Emissions Factor Guide to Air Force Mobile Sources* (AFCEC 2013).

(3) ICAO Engine Exhaust Emissions Data Bank - Subsonic Engines - (ICAO 2013).

Table D3.1-2. HAP Emission Factors, KC-135 and KC-46A Aircraft

Engine Type	Emission Factor (lb/1000 lb fuel) (1)													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
F108-CF-100														
Idle	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Approach	1.50E-02	0.00E+00	0.00E+00	0.00E+00	3.22E-03	6.23E-03	5.53E-04	1.61E-03	0.00E+00	1.85E-03	8.63E-04	7.63E-04	4.46E-02	3.81E-03
Intermediate	5.58E-03	0.00E+00	0.00E+00	0.00E+00	4.25E-04	1.42E-03	0.00E+00	5.42E-04	0.00E+00	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
Military	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03
P&W 4062 (3)														
Idle	1.78E+00	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Approach	1.48E-02	5.13E-03	2.94E-03	6.50E-04	2.02E-03	7.71E-04	2.09E-04	3.39E-04	3.71E-04	1.85E-03	8.63E-04	7.63E-04	4.46E-02	3.81E-03
Intermediate	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
Military	1.31E-02	4.56E-03	2.61E-03	5.78E-04	1.79E-03	6.85E-04	1.86E-04	3.01E-04	3.30E-04	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03

Notes: (1) Data are for one engine. The KC-135 has 4 engines and the KC-46A has 2 engines.

(2) Data from *Air Emissions Factor Guide to Air Force Mobile Sources* (AFCEC 2013), Table 2-9.

Table D3.1-3. Land and Take-off/Touch and Go Times in Mode and Fuel Usages - KC-135 and KC-46A Aircraft

	LTO			Touch & Go	
	Time in Mode (TIM)		Fuel Usage	TIM	Fuel Usage
Aircraft/Mode (Engine Throttle Setting)	Minutes	Hours	Pounds	Hours	Pounds
KC-135 (2)					
Taxi Out (Idle)	32.8	0.55	2217		
Take-off (Military)	0.7	0.01	364	0.01	364
Climbout (Intermediate)	2.5	0.04	1081	0.04	1081
Approach	5.2	0.09	854	0.09	854
Taxi In (Idle)	14.9	0.25	1007		
Totals	56.1	0.94	5523	0.14	2299
KC-46A (2)					
Taxi Out (Idle)	32.8	0.55	1818		
Take-off (Military)	0.7	0.01	505	0.01	505
Climbout (Intermediate)	2.5	0.04	1406	0.04	1406
Approach	5.2	0.09	988	0.09	988
Taxi In (Idle)	14.9	0.25	826		
Totals	56.1	0.94	5543	0.14	2899
APU Use, KC-46A (3)		Hours			
Pre-Flight - OBIGGS + Electric + Max ECS		1.50			
Pre-Flight - Main Engine Start + Electric		0.03			
Post-Flight - Electric + Min ECS		0.58			
Total Hours per LTO		2.12			

Notes: (1) Fuel usage per aircraft.

(2) TIM Data from Table 2-4, Transport Aircraft (AFCEC 2013).

(3) APU use from FTU/MOB1 Draft EIS.

Table D3.1-4. Land and Take-off/Touch and Go Total Fuel Usages and Emissions - KC-135 and KC-46A Aircraft

Aircraft/Mode	LTO			Emissions (Pounds)								
LTOs	Time in Mode (TIM)		Fuel Usage	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
	Minutes	Hours	Pounds									
KC-135 (2)												
Taxi Out (Idle)	32.8	0.55	2217	4.67	68.05	8.87	2.35	0.13	0.13	7129.08	0.20	0.22
Take-off (Military)	0.7	0.01	364	0.02	0.03	6.74	0.39	0.03	0.03	1170.80	0.03	0.04
Climbout (Intermediate)	2.5	0.04	1081	0.06	0.10	17.30	1.15	0.05	0.05	3476.75	0.10	0.11
Approach	5.2	0.09	854	0.08	3.59	7.00	0.91	0.05	0.05	2746.08	0.08	0.09
Taxi In (Idle)	14.9	0.25	1007	2.12	30.91	4.03	1.07	0.06	0.06	3238.52	0.09	0.10
Totals	56.1	0.935	5523	6.94	102.69	43.93	5.85	0.32	0.32	17761.24	0.49	0.55
KC-46A (2)												
Taxi Out (Idle)	32.8	0.55	1818	22.71	77.48	6.87	1.93	0.20	0.18	5848.08	0.16	0.18
Take-off (Military)	0.7	0.01	505	0.05	0.31	17.33	0.53	0.04	0.04	1622.48	0.04	0.05
Climbout (Intermediate)	2.5	0.04	1406	0.11	0.70	36.52	1.49	0.10	0.08	4521.05	0.13	0.14
Approach	5.2	0.09	988	0.10	1.91	12.03	1.05	0.05	0.04	3178.75	0.09	0.10
Taxi In (Idle)	14.9	0.25	826	10.32	35.20	3.12	0.88	0.09	0.08	2656.60	0.07	0.08
Totals	56.1	0.935	5543	33.29	115.60	75.88	5.88	0.48	0.42	17826.96	0.49	0.55

Aircraft/Mode	Touch and Go			Emissions (Pounds)								
Touch and Go	Time in Mode (TIM)		Fuel Usage	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
	Minutes	Hours	Pounds									
KC-135 (2)												
Take-off (Military)	0.70	0.01	364	0.02	0.03	6.74	0.39	0.03	0.03	1170.80	0.03	0.04
Climbout (Intermediate)	2.50	0.04	1081	0.06	0.10	17.30	1.15	0.05	0.05	3476.75	0.10	0.11
Approach	5.20	0.09	854	0.08	3.59	7.00	0.91	0.05	0.05	2746.08	0.08	0.09
Totals	8.40	0.14	2299	0.16	3.72	31.03	2.44	0.13	0.13	7393.64	0.20	0.23
KC-46A (2)												
Take-off (Military)	0.7	0.01	505	0.05	0.31	17.33	0.53	0.04	0.04	1622.48	0.04	0.05
Climbout (Intermediate)	2.5	0.04	1406	0.11	0.70	36.52	1.49	0.10	0.08	4521.05	0.13	0.14
Approach	5.2	0.09	988	0.10	1.91	12.03	1.05	0.05	0.04	3178.75	0.09	0.10
Totals	8.40	0.14	2899	0.26	2.92	65.89	3.07	0.19	0.16	9322.28	0.26	0.29

Table D3.1-5. Land and Take-off/Touch and Go Total Fuel Usages and HAP Emissions - KC-135 and KC-46A Aircraft

Aircraft/Mode	LTO			Emissions (Pounds)													
LTOs	Time in Mode (TIM)		Fuel Usage	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
	Minutes	Hours	Pounds														
KC-135 (2)																	
Taxi Out (Idle)	32.8	0.55	2217	0.21	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.15	0.01
Take-off (Military)	0.7	0.01	364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1081	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Approach	5.2	0.09	854	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Taxi In (Idle)	14.9	0.25	1007	0.10	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Totals	56.1	0.94	5523	0.33	0.00	0.00	0.01	0.01	0.04	0.00	0.01	0.00	0.01	0.00	0.00	0.31	0.02
KC-46A (2)																	
Taxi Out (Idle)	32.8	0.55	1818	3.24	1.13	0.65	0.14	0.44	0.17	0.05	0.07	0.08	0.01	0.00	0.00	0.12	0.01
Take-off (Military)	0.7	0.01	505	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1406	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Approach	5.2	0.09	988	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Taxi In (Idle)	14.9	0.25	826	1.47	0.51	0.29	0.06	0.20	0.08	0.02	0.03	0.04	0.00	0.00	0.00	0.06	0.00
Totals	56.1	0.94	5543	4.75	1.65	0.95	0.21	0.65	0.25	0.07	0.11	0.12	0.01	0.00	0.00	0.29	0.02

Aircraft/Mode	Touch and Go			Emissions (Pounds)													
Touch and Go	Time in Mode (TIM)		Fuel Usage	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
	Minutes	Hours	Pounds														
KC-135 (2)																	
Take-off (Military)	0.70	0.01	364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.50	0.04	1081	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Approach	5.20	0.09	854	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Totals	8.40	0.14	2299	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.01
KC-46A (2)																	
Take-off (Military)	0.7	0.01	505	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1406	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Approach	5.2	0.09	988	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Totals	8.40	0.14	2899	0.04	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.01

Table D3.1-6. Annual Air Operations for Aircraft at Forbes - Baseline

	Number of Operations		
Aircraft	LTO	TGO	Total
KC-135	946	4280	10452

Table D3.1-7. KC-135 Aircraft Closed Pattern Operations at Forbes, Baseline

Scenario/Operation	Operations/Year		Engine Setting/Time in Mode per Operation (Minutes)					
	Fraction of Ops	Total Ops per Pattern	55%	58%	60%	70%	73%	85%
KC-135 CA VFR Right Turns South Side	0.02334748	100	1.08073231	1.05954148	3.23876605	0.6250811	0.10721551	0.60319134
KC-135 CB VFR Right Turns Southwest Side	0.44317768	1897	1.08073231	1.05954148	3.23876605	0.6250811	0.10721551	0.60319134
KC-135 CC IFR Right Turns Southwest Side	0.01552456	66	5.90400061	2.76893508	3.98841687	0.6250811	0.10721551	0.60319134
KC-135 CC_2 IFR Right Turns Southwest Side	0.01552456	66	7.81529572	2.8536984	3.907219	0.6250811	0.10721551	0.60319134
KC-135 CD IFR Right Turns Southwest Side	0.00078836	3	5.93735654	2.82544396	6.5061229	0.6250811	0.10721551	0.60319134
KC-135 CD_2 IFR Right Turns Southwest Side	0.00078836	3	5.93735654	2.82544396	6.5061229	0.6250811	0.10721551	0.60319134
KC-135 CE VFR Left Turns South Side	0.02334748	100	1.61109169	1.44097642	1.12190307	0.6250811	0.10721551	0.60319134
KC-135 CF VFR Left Turns Southwest Side	0.44317768	1897	1.61109169	1.44097642	1.12190307	0.6250811	0.10721551	0.60319134
KC-135 CG IFR Left Turns Southwest Side	0.03104912	133	7.81529572	1.51161252	4.17139801	0.6250811	0.10721551	0.60319134
KC-135 CH IFR Left Turns Southwest Side	0.00327471	14	2.36827143	7.25432736	7.71408428	0.6250811	0.10721551	0.60319134
Total Ops		4280						

Table D3.1-8. KC-135 Aircraft Closed Pattern Operations - Fuel Use and Emission Factors, Baseline

Factor			Engine Setting					
			55%	58%	60%	70%	73%	85%
Fuel Use, lbs/hr			19910.88	20916.72	21922.56	25945.92	27589.32	31204.8
Emission Factors, lbs/1000 lbs fuel								
VOC			0.0704	0.0683	0.0661	0.0575	0.0539	0.0460
CO			1.6313	1.3744	1.1175	0.0900	0.0900	0.0900
NOx			13.0750	13.5625	14.0500	16.0000	16.7813	18.5000
SO2			1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
PM10			0.0538	0.0531	0.0525	0.0500	0.0563	0.0700
PM2.5			0.0538	0.0531	0.0525	0.0500	0.0563	0.0700
CO2			3216	3216	3216	3216	3216	3216
CH4			0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
N2O			0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

Table D3.1-9. KC-135 Aircraft Closed Pattern Operations - Emissions Per Operation, Baseline

Emissions per operation, lbs			VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-135 CA VFR Right Turns South Side			0.1614	2.4721	37.2809	2.6974	0.1393	0.1393	8183.7166	0.2265	0.2545
KC-135 CB VFR Right Turns Southwest Side			0.1614	2.4721	37.2809	2.6974	0.1393	0.1393	8183.7166	0.2265	0.2545
KC-135 CC IFR Right Turns Southwest Side			0.3329	6.2082	70.1391	5.3160	0.2713	0.2713	16128.5599	0.4463	0.5015
KC-135 CC_2 IFR Right Turns Southwest Side			0.3776	7.2503	78.4159	5.9882	0.3054	0.3054	18167.9580	0.5028	0.5649
KC-135 CD IFR Right Turns Southwest Side			0.3959	7.2813	83.4757	6.3237	0.3213	0.3213	19185.9407	0.5310	0.5966
KC-135 CD_2 IFR Right Turns Southwest Side			0.3959	7.2813	83.4757	6.3237	0.3213	0.3213	19185.9407	0.5310	0.5966
KC-135 CE VFR Left Turns South Side			0.1317	2.0776	30.5185	2.2050	0.1152	0.1152	6689.9507	0.1851	0.2080
KC-135 CF VFR Left Turns Southwest Side			0.1317	2.0776	30.5185	2.2050	0.1152	0.1152	6689.9507	0.1851	0.2080
KC-135 CG IFR Left Turns Southwest Side			0.3521	6.7151	73.4267	5.5946	0.2857	0.2857	16973.7203	0.4697	0.5278
KC-135 CH IFR Left Turns Southwest Side			0.4470	7.9644	95.1308	7.1727	0.3628	0.3628	21761.7260	0.6022	0.6767
Emissions, closed pattern ops, tons/year			0.3440	5.5160	78.4510	5.7133	0.2958	0.2958	17333.8109	0.4797	0.5390

Table D3.1-10. Annual Air Emissions for KC-135 Aircraft Operations at Forbes - Baseline

Aircraft	Annual Emissions, Tons/year								
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-135 LTOs	3.28	48.57	20.78	2.77	0.15	0.15	8401.07	0.23	0.26
KC-135 Closed Pattern Ops	0.34	5.52	78.45	5.71	0.30	0.30	17333.81	0.48	0.54
Total Existing	3.63	54.09	99.23	8.48	0.45	0.45	25734.88	0.71	0.80

Table D3.1-11. Annual HAP Emissions for KC-135 Aircraft Operations at Forbes - Baseline

Aircraft	Annual Emissions, Tons/year													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-135 LTOs	0.16	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.15	0.01
KC-135 Closed Pattern Ops	0.05	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.20	0.01
Total Existing	0.20	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.00	0.01	0.01	0.01	0.35	0.03

Table D3.1-12. JP-8 AGE Equipment Emissions, Forbes, Baseline

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/hr						Annual Emissions (lbs/yr)					
						NOx	CO	VOC	PM10	PM2.5	SO2	NOx	CO	VOC	PM10	PM2.5	SO2
KC-135 AGE																	
Sorties:	946																
	Hours/Sortie																
Generator A/M32A-86	10	9460.00	6.47	79036.77	148	6.10E+00	4.57E-01	2.94E-01	9.10E-02	8.90E-02	4.60E-02	1.27E+02	9.53E+00	6.13E+00	1.90E+00	1.86E+00	9.59E-01
Start Cart A/M32A-60A	1	946.00	10.16	9612.58	180	1.82E+00	5.48E+00	2.70E-01	2.11E-01	2.05E-01	7.18E-02	3.80E+00	1.14E+01	5.63E-01	4.40E-01	4.28E-01	1.50E-01
Start Cart A/M32A-95	0.1	94.60	8.75	827.75	155	1.47E+00	5.86E+00	7.00E-01	1.10E-01	1.07E-01	6.19E-02	3.07E-01	1.22E+00	1.46E-01	2.29E-02	2.23E-02	1.29E-02
Heater/AC Ace 802-993 AC	10	9460.00	6.80	145256.77	272	2.94E+00	1.50E-01	2.04E-01	1.98E-01	1.92E-01	4.80E-02	6.13E+01	3.13E+00	4.25E+00	4.13E+00	4.00E+00	1.00E+00
MA-3C Air Conditioner	2	1892.00	7.12	12816.77	120	4.17E+00	3.17E-01	5.30E-02	1.09E-01	1.05E-01	5.00E-02	1.74E+01	1.32E+00	2.21E-01	4.55E-01	4.38E-01	2.09E-01
H1	5	4730.00	0.39	1735.60	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.65E+00	1.89E+00	1.04E+00	1.14E+00	1.14E+00	3.13E-02
1H1	4	3784.00	0.39	1388.48	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.32E+00	1.51E+00	8.34E-01	9.09E-01	9.09E-01	2.50E-02
Light Cart NF-2	2	1892.00	1.02	1922.52	18	1.10E-01	8.00E-02	1.00E-02	1.00E-02	1.00E-02	7.18E-03	4.59E-01	3.34E-01	4.17E-02	4.17E-02	4.17E-02	3.00E-02
Air Compressor MC-1A	0.33	312.18	1.09	324.26	18.4	4.19E-01	2.67E-01	2.67E-01	7.10E-02	6.80E-02	8.00E-03	2.88E-01	1.84E-01	1.84E-01	4.89E-02	4.68E-02	5.51E-03
Total JP-8 AGE, Tons/year				hp-hrs	4480324.112							1.07E-01	1.53E-02	6.71E-03	4.54E-03	4.44E-03	1.21E-03

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.1-13. AGE HAP Emissions, Forbes, Baseline

Pollutant	JP-8			Gasoline	
	Emission Factors		Actual Annual Emissions (lbs/yr)	Emission Factor (lb/MMBTU)	Annual Emissions (lbs/yr)
	Turbine (lb/1000 gal)	Reciprocating (lb/1000 hp-hr)			
Arsenic	1.53E-03				
Acetaldehyde		5.40E-03	2.42E+01	7.00E-02	
Acrolein		6.48E-04	2.90E+00		
Benzene	7.65E-03	6.50E-03	2.91E+01		
Beryllium	4.31E-05				
1,3-Butadiene	2.22E-03	2.74E-04	1.23E+00		
Cadmium	6.67E-04				
Chromium	1.53E-03				
Formaldehyde	3.89E-02	8.30E-03	3.72E+01		
Lead	1.95E-03				
Manganese	1.10E-01				
Mercury	1.67E-04				
Maphthalene	4.87E-03	5.94E-04	2.66E+00		
Nickel	6.39E-04				
POM	5.56E-03	1.20E-03	5.38E+00		
Selenium	3.48E-03				
Toluene		2.90E-03	1.30E+01		
Xylenes		2.00E-03	8.96E+00		
Total			1.10E-02		

Table D3.1-14. JP-8 AGE Equipment GHG Emissions, Forbes, Baseline

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/gal			Annual Emissions (lbs/yr)		
						CO2	CH4	N2O	CO2	CH4	N2O
KC-135 AGE											
Sorties:	946										
	Hours/Sortie										
Generator A/M32A-86	10	9460.00	6.47	79036.77	148	2.11E+01	5.91E-04	6.80E-04	1.67E+06	4.67E+01	5.37E+01
Start Cart A/M32A-60A	1	946.00	10.16	9612.58	180	2.11E+01	5.91E-04	6.80E-04	2.03E+05	5.68E+00	6.54E+00
Start Cart A/M32A-95	0.1	94.60	8.75	827.75	155	2.11E+01	5.91E-04	6.80E-04	1.75E+04	4.89E-01	5.63E-01
Heater/AC Ace 802-993 AC	10	9460.00	6.80	145256.77	272	2.11E+01	5.91E-04	6.80E-04	3.06E+06	8.58E+01	9.88E+01
MA-3C Air Conditioner	2	1892.00	7.12	12816.77	120	2.11E+01	5.91E-04	6.80E-04	2.70E+05	7.57E+00	8.72E+00
H1	5	4730.00	0.39	1735.60	6.5	2.11E+01	5.91E-04	6.80E-04	3.66E+04	1.03E+00	1.18E+00
1H1	4	3784.00	0.39	1388.48	6.5	2.11E+01	5.91E-04	6.80E-04	2.93E+04	8.21E-01	9.44E-01
Light Cart NF-2	2	1892.00	1.02	1922.52	18	2.11E+01	5.91E-04	6.80E-04	4.06E+04	1.14E+00	1.31E+00
Air Compressor MC-1A	0.33	312.18	1.09	324.26	18.4	2.11E+01	5.91E-04	6.80E-04	6.84E+03	1.92E-01	2.20E-01
Total JP-8 AGE, Metric Tons/year									2.42E+03	6.78E-02	7.80E-02

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.1-15. Aircraft Engine Emissions - Engine Tests, Forbes, Baseline

						Emission Factors (lb/1000 lb fuel)						Emissions (lbs/yr)					
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	VOC	CO	NOx	SO2	PM10	PM2.5	VOC	CO	NOx	SO2	PM10	PM2.5
KC-135																	
Defueling	26	Idle	0.50	1	1,014	2.1	30.7	4.0	1.1	0.1	0.1	27.73	404.59	52.72	13.97	1.61	1.61
Maintenance Run	104	Idle	0.33	4	1,014	2.1	30.7	4.0	1.1	0.1	0.1	295.84	4,315.64	562.30	149.01	17.12	17.12
TRT Run 2 Engine	12	Idle	0.17	2	1,014	2.1	30.7	4.0	1.1	0.1	0.1	8.53	124.49	16.22	4.30	0.49	0.49
	12	80% RPM	0.08	2	7801.2	0.0	0.1	18.5	1.1	0.1	0.1	0.72	1.40	288.64	16.54	1.71	1.71
TRT Run 4 Engine	9	Idle	0.17	4	1,014	2.1	30.7	4.0	1.1	0.1	0.1	12.80	186.73	24.33	6.45	0.74	0.74
	9	80% RPM	0.08	4	7801.2	0.0	0.1	18.5	1.1	0.1	0.1	1.08	2.11	432.97	24.81	2.57	2.57
												0.17	2.52	0.69	0.11	0.01	0.01

Table D3.1-16. HAP Emissions, Engine Tests, Forbes, Baseline

						Emission Factor (lb/1000 lb fuel) (1)													
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-135																			
Defueling	26	Idle	0.50	1	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Maintenance Run	104	Idle	0.33	4	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
TRT Run 2 Engine	12	Idle	0.17	2	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
	12	80% RPM	0.08	2	7801.2	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03
TRT Run 4 Engine	9	Idle	0.17	4	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
	9	80% RPM	0.08	4	7801.2	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03

Emissions, lbs/yr														
Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate	Total HAPs, TPY
1.25	0.00	0.00	0.04	0.03	0.12	0.01	0.02	0.02	0.03	0.01	0.01	0.89	0.06	
13.37	0.00	0.00	0.41	0.27	1.26	0.10	0.23	0.21	0.32	0.13	0.14	9.49	0.68	
0.39	0.00	0.00	0.01	0.01	0.04	0.00	0.01	0.01	0.01	0.00	0.00	0.27	0.02	
0.11	0.00	0.00	0.00	0.02	0.02	0.00	0.01	0.00	0.02	0.01	0.01	0.03	0.04	
0.58	0.00	0.00	0.02	0.01	0.05	0.00	0.01	0.01	0.01	0.01	0.01	0.41	0.03	
0.16	0.00	0.00	0.00	0.03	0.03	0.00	0.01	0.00	0.03	0.01	0.01	0.05	0.06	
0.00792974	0	0	0.000237642	0.00017734	0.0007567	5.6051E-05	0.00014176	0.00012128	0.000212308	8.13888E-05	8.87628E-05	0.00556955	0.00044463	0.01581717

Table D3.1-17. GHG Emissions, Engine Tests, Forbes, Baseline

						Emission Factor(1)					
						CO2	CH4	N2O	Actual Emissions (lb/yr)		
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	(lb/1000 lb fuel)	(lb/1000 lb fuel)	(lb/1000 lb fuel)	CO2	CH4	N2O
KC-135											
Defueling	26	Idle	0.50	1	1,014	3,216.0	0.1	0.1	42,383.28	1.17	1.32
Maintenance Run	104	Idle	0.33	4	1,014	3,216.0	0.1	0.1	452,088.30	12.51	14.06
TRT Run 2 Engine	12	Idle	0.17	2	1,014	3,216.0	0.1	0.1	13,041.01	0.36	0.41
	12	80% RPM	0.08	2	7801.2	3,216.0	0.1	0.1	50,177.32	1.39	1.56
TRT Run 4 Engine	9	Idle	0.17	4	1,014	3,216.0	0.1	0.1	19,561.51	0.54	0.61
	9	80% RPM	0.08	4	7801.2	3,216.0	0.1	0.1	75,265.98	2.08	2.34
Total, tpy									296	0.01	0.01

(1) CO2 emission factors obtained from AFCEC 2013.
CH4 and N2O emission factors were derived from Table A-101 for jet fuel in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005, using density of JP-8 as 6.8 lb/gallon.

Table D3.1-18. Annual Worker Population and VMT at Forbes - KC-46A Project Scenarios

Scenario	Total # of Workers	Annual On-Base VMT[1]	Annual Off-Base VMT[2]
Existing	945	245700	1941030
Proposed Action	1126	292760	2312804

[1]On-Base mileage based on 1.00 miles from 2010 AEI; total mileage obtained from AEI.

[2]Off-Base mileage based on distance to downtown Topeka, 7.9 miles; assume 260 days/year

Table D3.1-19. Annual Average On-Road Vehicle Emission Factors - Forbes

		Emission Factors (Grams/Mile)						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	0.606	9.55	0.449	0.007	0.025	0.011	368.1
LDDT	0.03	0.132	0.808	0.2	0.003	0.053	0.037	314
LDGT	60.32	0.851	11.32	0.695	0.01	0.025	0.011	516.1
LDDT	0.2	0.393	0.708	0.46	0.006	0.06	0.044	599.2
HDGV	0	1.125	28.16	1.198	0.017	0.049	0.032	905.3
HDDV	0	0.684	2.315	3.359	0.012	0.129	0.1	1245.6
MC	1.9	3.29	27.81	0.84	0.003	0.037	0.021	177.4
Proposed Action (Year 2018) (1)								
LDGV	37.55	0.459	8.66	0.321	0.007	0.025	0.011	368
LDDT	0.03	0.087	0.692	0.088	0.003	0.038	0.023	314.1
LDGT	60.32	0.683	9.88	0.522	0.01	0.025	0.011	516.6
LDDT	0.2	0.305	0.6	0.317	0.006	0.047	0.032	598.6
HDGV	0	0.815	26.48	0.675	0.017	0.04	0.025	904
HDDV	0	0.583	1.428	1.919	0.012	0.078	0.053	1245.9
MC	1.9	3.29	27.81	0.84	0.003	0.037	0.021	177.4

Notes: (1) Emission factors from AFCEC 2013, Table 5-13, for 2017 used to provide a conservative estimate of emissions for 2018

Table D3.1-20. Annual Average On-Base Vehicle Emissions, Forbes

		Emissions, lbs/year						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	123.26	1942.47	91.33	1.42	5.09	2.24	74871.66
LDDT	0.03	0.02	0.13	0.03	0.00	0.01	0.01	51.03
LDGT	60.32	278.06	3698.70	227.08	3.27	8.17	3.59	168630.79
LDDT	0.2	0.43	0.77	0.50	0.01	0.07	0.05	649.15
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	33.86	286.22	8.65	0.03	0.38	0.22	1825.78
Total Existing, tons/year		0.22	2.96	0.16	0.00	0.01	0.00	123.01
Proposed Action (Year 2018) (1)								
LDGV	37.55	111.24	2098.82	77.80	1.70	6.06	2.67	89187.92
LDDT	0.03	0.02	0.13	0.02	0.00	0.01	0.00	60.82
LDGT	60.32	265.91	3846.51	203.23	3.89	9.73	4.28	201124.05
LDDT	0.2	0.39	0.77	0.41	0.01	0.06	0.04	772.71
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	40.35	341.04	10.30	0.04	0.45	0.26	2175.48
Total Proposed Action, tons/year		0.21	3.14	0.15	0.00	0.01	0.00	146.66

Table D3.1-21. Annual Average Off-Base Vehicle Emissions, Forbes

		Emissions, lbs/year						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	973.76	15345.54	721.48	11.25	40.17	17.68	591486.09
LDDT	0.03	0.17	1.04	0.26	0.00	0.07	0.05	403.11
LDGT	60.32	2196.64	29219.75	1793.97	25.81	64.53	28.39	1332183.25
LDDT	0.2	3.36	6.06	3.94	0.05	0.51	0.38	5128.27
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	267.50	2261.12	68.30	0.24	3.01	1.71	14423.68
Total Existing, tons/year		1.72	23.42	1.29	0.02	0.05	0.02	971.81
Proposed Action (Year 2018) (1)								
LDGV	37.55	737.55	13915.43	515.80	11.25	40.17	17.68	591325.40
LDDT	0.03	0.11	0.89	0.11	0.00	0.05	0.03	403.23
LDGT	60.32	1762.99	25502.75	1347.41	25.81	64.53	28.39	1333473.87
LDDT	0.2	2.61	5.14	2.71	0.05	0.40	0.27	5123.13
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	267.50	2261.12	68.30	0.24	3.01	1.71	14423.68
Total Proposed Action, tons/year		1.39	20.84	0.97	0.02	0.05	0.02	972.37

Table D3.1-22. Annual Air Operations for Aircraft at Forbes - Proposed Action

	Number of Operations		
Aircraft	LTO	TGO	Total
KC-46A	1286	5995	14562

Table D3.1-23. KC-46A Aircraft Closed Pattern Operations at Forbes - KC-46A Proposed Scenarios

	Operations/Year		Engine Setting/Time in Mode per Operation (Minutes)						
Scenario/Operation	Fraction of Ops	Total Ops per Pattern	55%	58%	60%	68%	73%	83%	85%
KC-46A CA VFR Right Turns South Side	0.02336246	140	1.52770185	1.04541426	2.57545944	0.66856113	0.06861792	0.3602441	0.39626852
KC-46A CB VFR Right Turns Southwest Side	0.44393009	2661	1.52770185	1.04541426	2.57545944	0.66856113	0.06861792	0.3602441	0.39626852
KC-46A CC IFR Right Turns Southwest Side	0.01553171	93	5.24755579	1.580018	4.11836013	1.16386557	0.06861792	0.39455307	0.33222512
KC-46A CC_2 IFR Right Turns Southwest Side	0.01553171	93	5.24755579	1.03333177	6.83322258	1.16386557	0.06861792	0.39455307	0.33222512
KC-46A CD IFR Right Turns Southwest Side	0.00082201	5	10.6572214	1.00489145	2.43021817	1.16386557	0.06861792	0.39455307	0.33222512
KC-46A CD_2 IFR Right Turns Southwest Side	0.00082201	5	10.6572214	1.00489145	2.43021817	1.16386557	0.06861792	0.39455307	0.33222512
KC-46A CE VFR Left Turns South Side	0.02336246	140	1.52770185	1.04541426	2.57545944	0.66856113	0.06861792	0.3602441	0.39626852
KC-46A CF VFR Left Turns Southwest Side	0.44393009	2661	1.52770185	1.04541426	2.57545944	0.66856113	0.06861792	0.3602441	0.39626852
KC-46A CG IFR Left Turns Southwest Side	0.03106342	186	5.24755579	0.52140594	6.25469204	1.16386557	0.06861792	0.39455307	0.33222512
KC-46A CH IFR Left Turns Southwest Side	0.00164403	10	9.93973526	0.96065095	2.97021433	1.16386557	0.06861792	0.39455307	0.33222512
Total Ops		5995							

Table D3.1-24. KC-46A Aircraft Closed Pattern Operations - Fuel Use and Emission Factors

			Engine Setting/Time in Mode per Operation (Minutes)						
Factor			55%	58%	60%	68%	73%	83%	85%
Fuel Use, lbs/hr			22572	23688.8	24805.6	28379.36	30389.6	34928	36116
Emission Factors, lbs/1000 lbs									
VOC			0.0920	0.0909	0.0897	0.0860	0.0840	0.0819	0.0834
CO			1.2150	1.1435	1.0720	0.8432	0.7145	0.5138	0.5275
NOx			19.0750	19.7655	20.4560	22.6656	23.9085	27.0275	28.0750
SO2			1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
PM10			0.0600	0.0610	0.0620	0.0652	0.0670	0.0713	0.0725
PM2.5			0.0500	0.0510	0.0520	0.0552	0.0570	0.0613	0.0625
CO2			3216	3216	3216	3216	3216	3216	3216
CH4			0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
N2O			0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

Table D3.1-25. KC-46A Aircraft Closed Pattern Operations - Emissions Per Operation

Emissions per operation, lbs			VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-46A CA VFR Right Turns South Side			0.2531	2.8367	61.2646	3.0225	0.1809	0.1523	9170.2396	0.2538	0.2851
KC-46A CB VFR Right Turns Southwest Side			0.2531	2.8367	61.2646	3.0225	0.1809	0.1523	9170.2396	0.2538	0.2851
KC-46A CC IFR Right Turns Southwest Side			0.4768	5.6496	109.9461	5.6344	0.3311	0.2780	17094.6253	0.4731	0.5315
KC-46A CC_2 IFR Right Turns Southwest Side			0.5579	6.6060	128.6396	6.5954	0.3876	0.3254	20010.1143	0.5538	0.6222
KC-46A CD IFR Right Turns Southwest Side			0.5808	7.1145	130.0011	6.8112	0.3961	0.3319	20664.7895	0.5719	0.6426
KC-46A CD_2 IFR Right Turns Southwest Side			0.5808	7.1145	130.0011	6.8112	0.3961	0.3319	20664.7895	0.5719	0.6426
KC-46A CE VFR Left Turns South Side			0.2531	2.8367	61.2646	3.0225	0.1809	0.1523	9170.2396	0.2538	0.2851
KC-46A CF VFR Left Turns Southwest Side			0.2531	2.8367	61.2646	3.0225	0.1809	0.1523	9170.2396	0.2538	0.2851
KC-46A CG IFR Left Turns Southwest Side			0.5180	6.1185	119.7521	6.1276	0.3604	0.3026	18590.9093	0.5145	0.5781
KC-46A CH IFR Left Turns Southwest Side			0.5744	7.0059	129.0739	6.7432	0.3927	0.3291	20458.5274	0.5662	0.6361
Emissions, closed pattern ops, tons/year			0.8111	9.1567	195.1626	9.6741	0.5776	0.4863	29350.8442	0.8123	0.9127

Table D3.1-26. Annual Air Emissions for KC-46A Aircraft Operations at Forbes - Proposed Action

Aircraft	Annual Emissions, Tons/year								
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-46A LTOs	21.40	74.33	48.79	3.78	0.31	0.27	11462.73	0.32	0.36
KC-46A T&G	0.81	9.16	195.16	9.67	0.58	0.49	29350.84	0.81	0.91
APU	0.05	0.45	9.16	0.76	0.07	0.05	1871.62	0.00	0.00
Total Proposed Action	22.27	83.94	253.12	14.22	0.95	0.81	42685.20	1.13	1.27

Table D3.1-27. Annual HAP Emissions for KC-46A Aircraft Operations at Forbes - Proposed Action

Aircraft	Annual Emissions, Tons/year													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-46A LTOs	3.06	1.06	0.61	0.13	0.42	0.16	0.04	0.07	0.08	0.01	0.00	0.00	0.19	0.01
KC-46A Closed Pattern Ops	0.11	0.04	0.02	0.00	0.02	0.01	0.00	0.00	0.00	0.01	0.01	0.01	0.35	0.03
Total Proposed Action	3.17	1.10	0.63	0.14	0.43	0.17	0.04	0.07	0.08	0.02	0.01	0.01	0.54	0.04

Table D3.1-28. JP-8 AGE Equipment Emissions, Forbes, Proposed Action

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/hr						Annual Emissions (lbs/yr)					
						NOx	CO	VOC	PM10	PM2.5	SO2	NOx	CO	VOC	PM10	PM2.5	SO2
KC-46A AGE																	
Sorties:	1286																
	Hours/Sortie																
Generator A/M32A-86	10	12860.00	6.47	107443.23	148	6.10E+00	4.57E-01	2.94E-01	9.10E-02	8.90E-02	4.60E-02	1.73E+02	1.30E+01	8.34E+00	2.58E+00	2.52E+00	1.30E+00
Start Cart A/M32A-60A	1	1286.00	10.16	13067.42	180	1.82E+00	5.48E+00	2.70E-01	2.11E-01	2.05E-01	7.18E-02	5.16E+00	1.55E+01	7.65E-01	5.98E-01	5.81E-01	2.04E-01
Start Cart A/M32A-95	0.1	128.60	8.75	1125.25	155	1.47E+00	5.86E+00	7.00E-01	1.10E-01	1.07E-01	6.19E-02	4.17E-01	1.66E+00	1.98E-01	3.12E-02	3.03E-02	1.75E-02
Heater/AC Ace 802-993 AC	10	12860.00	6.80	197463.23	272	2.94E+00	1.50E-01	2.04E-01	1.98E-01	1.92E-01	4.80E-02	8.33E+01	4.25E+00	5.78E+00	5.61E+00	5.44E+00	1.36E+00
MA-3C Air Conditioner	2	2572.00	7.12	17423.23	120	4.17E+00	3.17E-01	5.30E-02	1.09E-01	1.05E-01	5.00E-02	2.36E+01	1.80E+00	3.01E-01	6.18E-01	5.95E-01	2.84E-01
H1	5	6430.00	0.39	2359.40	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	2.24E+00	2.57E+00	1.42E+00	1.55E+00	1.55E+00	4.25E-02
1H1	4	5144.00	0.39	1887.52	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.79E+00	2.05E+00	1.13E+00	1.24E+00	1.24E+00	3.40E-02
Light Cart NF-2	2	2572.00	1.02	2613.48	18	1.10E-01	8.00E-02	1.00E-02	1.00E-02	1.00E-02	7.18E-03	6.24E-01	4.54E-01	5.67E-02	5.67E-02	5.67E-02	4.07E-02
Air Compressor MC-1A	0.33	424.38	1.09	440.81	18.4	4.19E-01	2.67E-01	2.67E-01	7.10E-02	6.80E-02	8.00E-03	3.92E-01	2.50E-01	2.50E-01	6.64E-02	6.36E-02	7.48E-03
Total JP-8 AGE, Tons/year				hp-hrs	6090588.592							1.45E-01	2.08E-02	9.12E-03	6.17E-03	6.04E-03	1.65E-03

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.1-29. AGE HAP Emissions, Forbes, Proposed Action

Pollutant	JP-8			Gasoline	
	Emission Factors		Actual Annual Emissions (lbs/yr)	Emission Factor (lb/MMBTU)	Annual Emissions (lbs/yr)
	Turbine (lb/1000 gal)	Reciprocating (lb/1000 hp-hr)			
Arsenic	1.53E-03				
Acetaldehyde		5.40E-03	3.29E+01	7.00E-02	
Acrolein		6.48E-04	3.95E+00		
Benzene	7.65E-03	6.50E-03	3.96E+01		
Beryllium	4.31E-05				
1,3-Butadiene	2.22E-03	2.74E-04	1.67E+00		
Cadmium	6.67E-04				
Chromium	1.53E-03				
Formaldehyde	3.89E-02	8.30E-03	5.06E+01		
Lead	1.95E-03				
Manganese	1.10E-01				
Mercury	1.67E-04				
Maphthalene	4.87E-03	5.94E-04	3.62E+00		
Nickel	6.39E-04				
POM	5.56E-03	1.20E-03	7.31E+00		
Selenium	3.48E-03				
Toluene		2.90E-03	1.77E+01		
Xylenes		2.00E-03	1.22E+01		
Total			1.49E-02		

Table D3.1-30. JP-8 AGE Equipment GHG Emissions, Forbes, Proposed Action

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/gal			Annual Emissions (lbs/yr)		
						CO2	CH4	N2O	CO2	CH4	N2O
KC-46A AGE											
Sorties:	1286										
	Hours/Sortie										
Generator A/M32A-86	10	12860.00	6.47	107443.23	148	2.11E+01	5.91E-04	6.80E-04	2.27E+06	6.35E+01	7.31E+01
Start Cart A/M32A-60A	1	1286.00	10.16	13067.42	180	2.11E+01	5.91E-04	6.80E-04	2.76E+05	7.72E+00	8.89E+00
Start Cart A/M32A-95	0.1	128.60	8.75	1125.25	155	2.11E+01	5.91E-04	6.80E-04	2.37E+04	6.65E-01	7.65E-01
Heater/AC Ace 802-993 AC	10	12860.00	6.80	197463.23	272	2.11E+01	5.91E-04	6.80E-04	4.17E+06	1.17E+02	1.34E+02
MA-3C Air Conditioner	2	2572.00	7.12	17423.23	120	2.11E+01	5.91E-04	6.80E-04	3.68E+05	1.03E+01	1.18E+01
H1	5	6430.00	0.39	2359.40	6.5	2.11E+01	5.91E-04	6.80E-04	4.98E+04	1.39E+00	1.60E+00
1H1	4	5144.00	0.39	1887.52	6.5	2.11E+01	5.91E-04	6.80E-04	3.98E+04	1.12E+00	1.28E+00
Light Cart NF-2	2	2572.00	1.02	2613.48	18	2.11E+01	5.91E-04	6.80E-04	5.51E+04	1.54E+00	1.78E+00
Air Compressor MC-1A	0.33	424.38	1.09	440.81	18.4	2.11E+01	5.91E-04	6.80E-04	9.30E+03	2.61E-01	3.00E-01
Total JP-8 AGE, Metric Tons/year									3.29E+03	9.22E-02	1.06E-01

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.1-31. Aircraft Engine Emissions - Engine Tests, Proposed Action, Forbes

						Emission Factors (lb/1000 lb fuel)						Emissions (lbs/yr)					
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	VOC	CO	NOx	SO2	PM10	PM2.5	VOC	CO	NOx	SO2	PM10	PM2.5
KC-46A																	
Defueling	36	Idle	0.50	1	1,663	12.5	42.6	3.8	1.1	0.1	0.1	373.89	1,275.64	113.16	31.73	3.29	2.99
Maintenance Run	145	Idle	0.33	2	1,663	12.5	42.6	3.8	1.1	0.1	0.1	2,007.93	6,850.67	607.73	170.42	17.69	16.08
TRT Run 1 Engine	17	Idle	0.17	1	1,663	12.5	42.6	3.8	1.1	0.1	0.1	58.85	200.80	17.81	5.00	0.52	0.47
	17	80% RPM	0.08	1	16869.6	0.1	0.5	26.0	1.1	0.1	0.1	1.92	11.95	620.89	25.33	1.67	1.43
TRT Run 2 Engine	13	Idle	0.17	2	1,663	12.5	42.6	3.8	1.1	0.1	0.1	90.01	307.10	27.24	7.64	0.79	0.72
	13	80% RPM	0.08	2	16869.6	0.1	0.5	26.0	1.1	0.1	0.1	2.94	18.28	949.59	38.74	2.56	2.19
												1.27	4.33	1.17	0.14	0.01	0.01

Table D3.1-32. HAP Emissions, Engine Tests, Proposed Action, Forbes

						Emission Factor (lb/1000 lb fuel) (1)													
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-46A																			
Defueling	36	Idle	0.50	1	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
Maintenance Run	145	Idle	0.33	2	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
TRT Run 2 Engine	17	Idle	0.17	1	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
	17	80% RPM	0.08	1	16869.6	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
TRT Run 4 Engine	13	Idle	0.17	2	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
	13	80% RPM	0.08	2	16869.6	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03

Emissions, lbs/yr														
Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate	Total HAPs, TPY
18.53	10.62	2.35	7.29	2.78	0.76	1.22	1.34	0.10	0.03	0.03	2.02	0.15	0.15	
99.50	57.05	12.61	39.17	14.96	4.06	6.57	7.21	0.53	0.15	0.16	10.85	0.78	0.78	
2.92	1.67	0.37	1.15	0.44	0.12	0.19	0.21	0.02	0.00	0.00	0.32	0.02	0.02	
0.27	0.10	0.05	0.01	0.04	0.01	0.00	0.01	0.01	0.04	0.02	0.01	1.21	0.06	
4.46	2.56	0.57	1.76	0.67	0.18	0.29	0.32	0.02	0.01	0.01	0.49	0.03	0.03	
0.42	0.15	0.08	0.02	0.06	0.02	0.01	0.01	0.01	0.06	0.03	0.02	1.85	0.09	
0.0630491	0.03607154	0.00801257	0.024696031	0.00947242	0.0025763	0.00414673	0.0045497	0.00034409	0.000145698	0.000122073	0.006854255	0.00202076	0.00056816	0.16262942

Table D3.1-33. GHG Emissions, Engine Tests, Proposed Action, Forbes

						Emission Factor(1)					
						CO2	CH4	N2O	Actual Emissions (lb/yr)		
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	(lb/1000 lb fuel)	(lb/1000 lb fuel)	(lb/1000 lb fuel)	CO2	CH4	N2O
KC-46A											
Defueling	36	Idle	0.50	1	1,663	3,216.0	0.1	0.1	96,279.32	2.66	2.99
Maintenance Run	145	Idle	0.33	2	1,663	3,216.0	0.1	0.1	517,055.62	14.31	16.08
TRT Run 2 Engine	17	Idle	0.17	1	1,663	3,216.0	0.1	0.1	15,155.08	0.42	0.47
	17	80% RPM	0.08	1	16869.6	3,216.0	0.1	0.1	76,857.90	2.13	2.39
TRT Run 4 Engine	13	Idle	0.17	2	1,663	3,216.0	0.1	0.1	23,178.36	0.64	0.72
	13	80% RPM	0.08	2	16869.6	3,216.0	0.1	0.1	117,547.37	3.25	3.66
Total, tpy									384	0.01	0.01

(1) CO2 emission factors obtained from AFCEC 2013.
CH4 and N2O emission factors were derived from Table A-101 for jet fuel in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005, using density of JP-8 as 6.8 lb/gallon.

Table D3.1-34. Forbes Comparison of Emissions

	Annual Emissions, tons/year					
Baseline	VOC	CO	NOx	SO2	PM10	PM2.5
Aircraft Ops	3.63	54.09	99.23	8.48	0.45	0.45
AGE	0.01	0.02	0.02	0.00	0.00	0.00
Engine Tests	0.17	2.52	0.69	0.11	0.01	0.01
POVs	1.94	26.38	1.46	0.02	0.06	0.03
Total	5.75	83.00	101.39	8.61	0.53	0.49
Proposed Action	VOC	CO	NOx	SO2	PM10	PM2.5
Aircraft Ops	22.27	83.94	253.12	14.22	0.95	0.81
AGE	0.01	0.02	0.02	0.00	0.01	0.01
Engine Tests	1.27	4.33	1.17	0.14	0.01	0.01
POVs	1.59	23.99	1.11	0.02	0.06	0.03
Total	25.14	112.28	255.42	14.38	1.04	0.86
Net Increase	19.40	29.28	154.03	5.77	0.51	0.37

Table D3.1-35. Forbes Comparison of HAP Emissions

	Annual HAP Emissions, tons/year													
Baseline	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
Aircraft Ops	0.20	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.00	0.01	0.01	0.01	0.35	0.03
AGE	0.02	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Engine Tests	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00
Total	0.23	0.01	0.00	0.01	0.03	0.04	0.00	0.01	0.00	0.01	0.01	0.01	0.35	0.03
Proposed Action	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
Aircraft Ops	3.17	1.10	0.63	0.14	0.43	0.17	0.04	0.07	0.08	0.02	0.01	0.01	0.54	0.04
AGE	0.03	0.02	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Engine Tests	0.06	0.04	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.00
Total	3.26	1.15	0.64	0.17	0.46	0.17	0.05	0.08	0.08	0.02	0.01	0.01	0.54	0.04
Net Increase	3.03	1.14	0.64	0.16	0.44	0.13	0.05	0.06	0.08	0.01	0.00	0.01	0.19	0.01

Table D3.1-36. Forbes Comparison of GHG Emissions

	Annual GHG Emissions, metric tons/year			
Baseline	CO2	CH4	N2O	CO2e
Aircraft Ops	23347	0.65	0.73	23585
AGE	2421	0.07	0.08	2446
Engine Tests	296	0.01	0.01	299
POVs	993	0.00	0.00	993
Total	27056	0.72	0.81	27324
Proposed Action	CO2	CH4	N2O	
Aircraft Ops	38724	1.02	1.15	39102
AGE	3291	0.09	0.11	3326
Engine Tests	384	0.01	0.01	388
POVs	1015	0.00	0.00	1015
Total	43413	1.13	1.27	43831
Net Increase	16357	0.41	0.46	16507

Table D3.2-1 Engine Emission Factors by Throttle Setting - KC-135 and KC-46A Aircraft

Engine Type/Throttle Setting	Fuel Flow (Pounds/Hour)	Emission Factors, lbs/1000 lbs fuel								
		VOC	CO	NO_x	SO_2	PM_{10}	$PM_{2.5}$	CO_2	CH_4	N_2O
F-108-CF-100 (2)										
Idle	1013.76	2.1045	30.7	4	1.06	0.06	0.06	3216	8.90E-02	1.00E-01
Approach	2463.12	0.092	4.2	8.2	1.06	0.06	0.06	3216	8.90E-02	1.00E-01
Intermediate	6486.48	0.0575	0.09	16	1.06	0.05	0.05	3216	8.90E-02	1.00E-01
Military	7801.2	0.046	0.09	18.5	1.06	0.07	0.07	3216	8.90E-02	1.00E-01
P&W 4062 (3)										
Idle	1663.2	12.489	42.61	3.78	1.06	0.11	0.1	3216	8.90E-02	1.00E-01
Approach	5702.4	0.1035	1.93	12.17	1.06	0.05	0.04	3216	8.90E-02	1.00E-01
Climbout	16869.6	0.0805	0.5	25.98	1.06	0.07	0.06	3216	8.90E-02	1.00E-01
Take-Off	21621.6	0.092	0.61	34.36	1.06	0.08	0.07	3216	8.90E-02	1.00E-01
		Emissions, Pounds/Hour								
APU Use - P&W 4062		0.04	0.33	6.72	0.56	0.05	0.04	1373		

Notes: (1) Data are for one engine. The KC-135R has 4 engines and the KC-46A has 2 engines.
(2) Data from *Air Emissions Factor Guide to Air Force Mobile Sources* (AFCEC 2013).
(3) ICAO Engine Exhaust Emissions Data Bank - Subsonic Engines - (ICAO 2013).

Table D3.2-2. HAP Emission Factors - KC-135 and KC-46A Aircraft

Engine Type	Emission Factor (lb/1000 lb fuel) (1)												
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
F108-CF-100													
Idle	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Approach	1.50E-02	0.00E+00	0.00E+00	0.00E+00	3.22E-03	6.23E-03	5.53E-04	1.61E-03	0.00E+00	1.85E-03	8.63E-04	7.63E-04	4.46E-02	3.81E-03
Intermediate	5.58E-03	0.00E+00	0.00E+00	0.00E+00	4.25E-04	1.42E-03	0.00E+00	5.42E-04	0.00E+00	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
Military	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03
P&W 4062 (3)													
Idle	1.78E+00	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Approach	1.48E-02	5.13E-03	2.94E-03	6.50E-04	2.02E-03	7.71E-04	2.09E-04	3.39E-04	3.71E-04	1.85E-03	8.63E-04	7.63E-04	4.46E-02	3.81E-03
Intermediate	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
Military	1.31E-02	4.56E-03	2.61E-03	5.78E-04	1.79E-03	6.85E-04	1.86E-04	3.01E-04	3.30E-04	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03

Notes: (1) Data are for one engine. The KC-135R has 4 engines and the KC-46A has 2 engines.
(2) Data from *Air Emissions Factor Guide to Air Force Mobile Sources* (AFCEC 2013), Table 2-9.

Table D3.2-3. Land and Take-off/Touch and Go Times in Mode and Fuel Usages - KC-135 and KC-46A Aircraft

	LTO			Touch & Go	
	Time in Mode (TIM)		Fuel Usage	TIM	Fuel Usage
Aircraft/Mode (Engine Throttle Setting)	Minutes	Hours	Pounds	Hours	Pounds
KC-135 (2)					
Taxi Out (Idle)	32.8	0.55	2217		
Take-off (Military)	0.7	0.01	364	0.01	364
Climbout (Intermediate)	2.5	0.04	1081	0.04	1081
Approach	5.2	0.09	854	0.09	854
Taxi In (Idle)	14.9	0.25	1007		
Totals	56.1	0.94	5523	0.14	2299
KC-46A (2)					
Taxi Out (Idle)	32.8	0.55	1818		
Take-off (Military)	0.7	0.01	505	0.01	505
Climbout (Intermediate)	2.5	0.04	1406	0.04	1406
Approach	5.2	0.09	988	0.09	988
Taxi In (Idle)	14.9	0.25	826		
Totals	56.1	0.94	5543	0.14	2899
APU Use, KC-46A (3)		Hours			
Pre-Flight - OBIGGS + Electric + Max ECS		1.50			
Pre-Flight - Main Engine Start + Electric		0.03			
Post-Flight - Electric + Min ECS		0.58			
Total Hours per LTO		2.12			

Notes: (1) Fuel usage per aircraft.

(2) TIM Data from Table 2-4, Transport Aircraft (AFCEC 2013).

(3) APU use from FTU/MOB1 Draft EIS.

Table D3.2-4. Land and Take-off/Touch and Go Total Fuel Usages and Emissions - KC-135 and KC-46A Aircraft

Aircraft/Mode	LTO			Emissions (Pounds)								
LTOs	Time in Mode (TIM)		Fuel Usage	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
	Minutes	Hours	Pounds									
KC-135 (2)												
Taxi Out (Idle)	32.8	0.55	2217	4.67	68.05	8.87	2.35	0.13	0.13	7129.08	0.20	0.22
Take-off (Military)	0.7	0.01	364	0.02	0.03	6.74	0.39	0.03	0.03	1170.80	0.03	0.04
Climbout (Intermediate)	2.5	0.04	1081	0.06	0.10	17.30	1.15	0.05	0.05	3476.75	0.10	0.11
Approach	5.2	0.09	854	0.08	3.59	7.00	0.91	0.05	0.05	2746.08	0.08	0.09
Taxi In (Idle)	14.9	0.25	1007	2.12	30.91	4.03	1.07	0.06	0.06	3238.52	0.09	0.10
Totals	56.1	0.935	5523	6.94	102.69	43.93	5.85	0.32	0.32	17761.24	0.49	0.55
KC-46A (2)												
Taxi Out (Idle)	32.8	0.55	1818	22.71	77.48	6.87	1.93	0.20	0.18	5848.08	0.16	0.18
Take-off (Military)	0.7	0.01	505	0.05	0.31	17.33	0.53	0.04	0.04	1622.48	0.04	0.05
Climbout (Intermediate)	2.5	0.04	1406	0.11	0.70	36.52	1.49	0.10	0.08	4521.05	0.13	0.14
Approach	5.2	0.09	988	0.10	1.91	12.03	1.05	0.05	0.04	3178.75	0.09	0.10
Taxi In (Idle)	14.9	0.25	826	10.32	35.20	3.12	0.88	0.09	0.08	2656.60	0.07	0.08
Totals	56.1	0.935	5543	33.29	115.60	75.88	5.88	0.48	0.42	17826.96	0.49	0.55

Aircraft/Mode	Touch and Go			Emissions (Pounds)								
Touch and Go	Time in Mode (TIM)		Fuel Usage	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
	Minutes	Hours	Pounds									
KC-135 (2)												
Take-off (Military)	0.70	0.01	364	0.02	0.03	6.74	0.39	0.03	0.03	1170.80	0.03	0.04
Climbout (Intermediate)	2.50	0.04	1081	0.06	0.10	17.30	1.15	0.05	0.05	3476.75	0.10	0.11
Approach	5.20	0.09	854	0.08	3.59	7.00	0.91	0.05	0.05	2746.08	0.08	0.09
Totals	8.40	0.14	2299	0.16	3.72	31.03	2.44	0.13	0.13	7393.64	0.20	0.23
KC-46A (2)												
Take-off (Military)	0.7	0.01	505	0.05	0.31	17.33	0.53	0.04	0.04	1622.48	0.04	0.05
Climbout (Intermediate)	2.5	0.04	1406	0.11	0.70	36.52	1.49	0.10	0.08	4521.05	0.13	0.14
Approach	5.2	0.09	988	0.10	1.91	12.03	1.05	0.05	0.04	3178.75	0.09	0.10
Totals	8.40	0.14	2899	0.26	2.92	65.89	3.07	0.19	0.16	9322.28	0.26	0.29

Table D3.2-5. Land and Take-off/Touch and Go Total Fuel Usages and HAP Emissions - KC-135 and KC-46A Aircraft

Aircraft/Mode	LTO			Emissions (Pounds)													
LTOs	Time in Mode (TIM)		Fuel Usage	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
	Minutes	Hours	Pounds														
KC-135 (2)																	
Taxi Out (Idle)	32.8	0.55	2217	0.21	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.15	0.01
Take-off (Military)	0.7	0.01	364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1081	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Approach	5.2	0.09	854	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Taxi In (Idle)	14.9	0.25	1007	0.10	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Totals	56.1	0.94	5523	0.33	0.00	0.00	0.01	0.01	0.04	0.00	0.01	0.00	0.01	0.00	0.00	0.31	0.02
KC-46A (2)																	
Taxi Out (Idle)	32.8	0.55	1818	3.24	1.13	0.65	0.14	0.44	0.17	0.05	0.07	0.08	0.01	0.00	0.00	0.12	0.01
Take-off (Military)	0.7	0.01	505	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1406	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Approach	5.2	0.09	988	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Taxi In (Idle)	14.9	0.25	826	1.47	0.51	0.29	0.06	0.20	0.08	0.02	0.03	0.04	0.00	0.00	0.00	0.06	0.00
Totals	56.1	0.94	5543	4.75	1.65	0.95	0.21	0.65	0.25	0.07	0.11	0.12	0.01	0.00	0.00	0.29	0.02

Aircraft/Mode	Touch and Go			Emissions (Pounds)													
Touch and Go	Time in Mode (TIM)		Fuel Usage	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
	Minutes	Hours	Pounds														
KC-135 (2)																	
Take-off (Military)	0.70	0.01	364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.50	0.04	1081	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Approach	5.20	0.09	854	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Totals	8.40	0.14	2299	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.01
KC-46A (2)																	
Take-off (Military)	0.7	0.01	505	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1406	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Approach	5.2	0.09	988	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Totals	8.40	0.14	2899	0.04	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.01

Table D3.2-6. Annual Air Operations for Aircraft at McGuire - Baseline

	Number of Operations		
Aircraft	LTO	TGO	Total
KC-135	834	3336	8340

Table D3.2-7. KC-135 Aircraft Closed Pattern Operations at McGuire, Baseline

	Operations/Year		Engine Setting/Time in Mode per Operation (Minutes)									
Scenario/Operation	Fraction of Ops	Total Ops per Pattern	48.5	52.5	55.0	57.5	58.5	60.0	60.5	62.5	70.5	75.0
CR01 IFR to RWY06 on South Side	0.0530	177	2.1406		8.5008		0.1362	2.0365	1.5710		0.7596	0.4919
CR02 TACAN RWY06 VFR Circle	0.0035	12	0.6319	0.8571	7.1268		0.1362	2.9128	1.5710		0.7596	0.4919
CR03 North Radar Track	0.0141	47	2.1406		5.0742		0.1362	1.6240	1.5710		0.7596	0.4919
CR04 Radar Track on 18C3	0.0059	20	2.1406		8.2663		0.1362	2.1209	1.5710		0.7596	0.4919
CR05 Radar Track on 18C4	0.0059	20	2.1406		6.8000		0.0681	2.1209	1.5710		0.7596	0.5567
CR06 Radar Track Continuous turn 150HDG to 90 HDG	0.0919	307	2.1406		7.4803		0.1362	2.1209	1.5712		0.7594	0.4919
CR07 Radar Track 150HDG for Crosswind	0.0141	47	2.1406		7.6444		0.1362	2.1209	1.5710		0.7596	0.4919
CR08 TACAN to Rwy 24 then VFR Circle to RWY 18	0.0071	24	0.6319	1.0058	7.2052	1.6424	0.1362	2.1650	1.5710		0.7596	0.4919
CR09 Radar track to North	0.0283	94	2.1406		6.5939		0.1362	3.9770	1.5710		0.7596	0.4919
CR10 Radar track on 36C3	0.0059	20	2.1406		7.3686		0.1362		3.6919		0.7596	0.4919
CR11 TACAN approach to RWY 36 VFR Circle to RWY 6	0.0059	20	0.6948	0.8238	7.2755	1.9866	0.1362	1.2953	1.5710		0.7596	0.4919
CV01 - North VFR	0.2122	708	0.7645	1.1669	0.6817	0.9162	0.1362		0.7571		0.3668	0.4919
CV02 - West VFR on 18C2	0.0353	118	0.7645	1.1669	0.6817	0.9162	0.1362		0.7571		0.3668	0.4919
CV03 - North VFR Inside Housing	0.0382	127	0.7645	1.1669	0.7397	0.7516	0.1362		0.7571		0.3668	0.4919
CV04 - North VFR Outside Housing	0.3775	1259	0.7645	1.1669	0.9721	1.5196	0.0681		0.7571		0.3668	0.5567
CV05 - VFR With Breakout	0.0657	219	0.7645	1.1670	0.6680		0.1362	0.6419	0.7571	2.9350	0.3668	0.4919
CV06 - West VFR on 36C2	0.0353	118	0.7645	1.1669	0.7397	0.8613	0.1362		0.7571		0.3668	0.4919
Total Ops		3336										

Table D3.2-8. KC-135 Aircraft Closed Pattern Operations - Fuel Use and Emission Factors, Baseline

	Engine Setting/Time in Mode per Operation (Minutes)									
Factor	48.5	52.5	55.0	57.5	58.5	60.0	60.5	62.5	70.5	**75.0**
Fuel Use, lbs/hr	17295.696	18905.04	19910.88	20916.72	21319.056	21922.56	22123.728	22928.4	26274.6	29232.72
Emission Factors, lbs/1000 lbs fuel										
VOC	0.0760	0.0726	0.0704	0.0683	0.0674	0.0661	0.0657	0.0640	0.0568	0.0503
CO	2.2991	1.8881	1.6313	1.3744	1.2716	1.1175	1.0661	0.8606	0.0900	0.0900
NOx	11.8075	12.5875	13.0750	13.5625	13.7575	14.0500	14.1475	14.5375	16.1563	17.5625
SO2	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
PM10	0.0554	0.0544	0.0538	0.0531	0.0529	0.0525	0.0524	0.0519	0.0513	0.0625
PM2.5	0.0554	0.0544	0.0538	0.0531	0.0529	0.0525	0.0524	0.0519	0.0513	0.0625
CO2	3216	3216	3216	3216	3216	3216	3216	3216	3216	3216
CH4	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
N2O	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

Table D3.2-9. KC-135 Aircraft Closed Pattern Operations - Emissions Per Operation, Baseline

Emissions per operation, lbs	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
CR01 IFR to RWY06 on South Side	0.3671	7.5825	73.0690	5.7050	0.2898	0.2898	17308.8124	0.4790	0.5382
CR02 TACAN RWY06 VFR Circle	0.3427	6.7066	69.8701	5.3864	0.2727	0.2727	16342.0124	0.4523	0.5081
CR03 North Radar Track	0.2770	5.5592	56.0837	4.3399	0.2208	0.2208	13167.1627	0.3644	0.4094
CR04 Radar Track on 18C3	0.3636	7.4901	72.4847	5.6552	0.2872	0.2872	17157.7017	0.4748	0.5335
CR05 Radar Track on 18C4	0.3293	6.6684	66.3436	5.1472	0.2618	0.2618	15616.4405	0.4322	0.4856
CR06 Radar Track Continuous turn 150HDG to 90 HDG	0.3453	7.0646	69.0735	5.3787	0.2732	0.2732	16318.7065	0.4516	0.5074
CR07 Radar Track 150HDG for Crosswind	0.3491	7.1534	69.7860	5.4364	0.2761	0.2761	16493.9067	0.4565	0.5129
CR08 TACAN to Rwy 24 then VFR Circle to RWY 18	0.3689	7.3190	74.7264	5.7809	0.2927	0.2927	17538.9678	0.4854	0.5454
CR09 Radar track to North	0.3694	7.3426	74.7566	5.7858	0.2930	0.2930	17553.8740	0.4858	0.5458
CR10 Radar track on 36C3	0.3428	6.9719	68.7658	5.3470	0.2715	0.2715	16222.5155	0.4489	0.5044
CR11 TACAN approach to RWY 36 VFR Circle to RWY 6	0.3550	7.1003	71.6865	5.5544	0.2815	0.2815	16851.8535	0.4664	0.5240
CV01 - North VFR	0.1240	2.4040	25.9387	1.9732	0.1017	0.1017	5986.4890	0.1657	0.1861
CV02 - West VFR on 18C2	0.1240	2.4040	25.9387	1.9732	0.1017	0.1017	5986.4890	0.1657	0.1861
CV03 - North VFR Inside Housing	0.1214	2.3566	25.4126	1.9328	0.0997	0.0997	5863.9644	0.1623	0.1823
CV04 - North VFR Outside Housing	0.1451	2.8224	30.2732	2.3061	0.1188	0.1188	6996.6470	0.1936	0.2176
CV05 - VFR With Breakout	0.1891	3.1850	41.1481	3.0673	0.1550	0.1550	9306.0728	0.2575	0.2894
CV06 - West VFR on 36C2	0.1240	2.4092	25.9314	1.9733	0.1017	0.1017	5986.9753	0.1657	0.1862
Emissions, closed pattern ops, tons/year	0.3160	6.2145	65.0183	4.9886	0.2551	0.2551	15135.2626	0.4189	0.4706

Table D3.2-10. Annual Air Emissions for KC-135 Aircraft Operations at McGuire - Baseline

Aircraft	Annual Emissions, Tons/year								
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-135 LTOs	2.89	42.82	18.32	2.44	0.14	0.14	7406.44	0.20	0.23
KC-135 T&G	0.32	6.21	65.02	4.99	0.26	0.26	15135.26	0.42	0.47
Total Existing	3.21	49.03	83.34	7.43	0.39	0.39	22541.70	0.62	0.70

Table D3.2-11. Annual HAP Emissions for KC-135 Aircraft Operations at McGuire - Baseline

Aircraft	Annual Emissions, Tons/year													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-135 LTOs	0.14	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.00	0.00	0.00	0.13	0.01
KC-135 Closed Pattern Ops	0.04	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.16	0.01
Total Existing	0.17	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.00	0.01	0.00	0.00	0.29	0.02

Table D3.2-12. JP-8 AGE Equipment Emissions, McGuire, Baseline

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/hr NOx	CO	VOC	PM10	PM2.5	SO2	Annual Emissions (lbs/yr) NOx	CO	VOC	PM10	PM2.5	SO2
KC-135 AGE																	
Sorties:	834																
	Hours/Sortie																
Generator A/M32A-86	10	8340.00	6.47	69679.35	148	6.10E+00	4.57E-01	2.94E-01	9.10E-02	8.90E-02	4.60E-02	1.12E+02	8.40E+00	5.41E+00	1.67E+00	1.64E+00	8.46E-01
Start Cart A/M32A-60A	1	834.00	10.16	8474.52	180	1.82E+00	5.48E+00	2.70E-01	2.11E-01	2.05E-01	7.18E-02	3.35E+00	1.01E+01	4.96E-01	3.88E-01	3.77E-01	1.32E-01
Start Cart A/M32A-95	0.1	83.40	8.75	729.75	155	1.47E+00	5.86E+00	7.00E-01	1.10E-01	1.07E-01	6.19E-02	2.70E-01	1.08E+00	1.29E-01	2.02E-02	1.97E-02	1.14E-02
Heater/AC Ace 802-993 AC	10	8340.00	6.80	128059.35	272	2.94E+00	1.50E-01	2.04E-01	1.98E-01	1.92E-01	4.80E-02	5.40E+01	2.76E+00	3.75E+00	3.64E+00	3.53E+00	8.83E-01
MA-3C Air Conditioner	2	1668.00	7.12	11299.35	120	4.17E+00	3.17E-01	5.30E-02	1.09E-01	1.05E-01	5.00E-02	1.53E+01	1.17E+00	1.95E-01	4.01E-01	3.86E-01	1.84E-01
H1	5	4170.00	0.39	1530.12	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.45E+00	1.66E+00	9.19E-01	1.00E+00	1.00E+00	2.76E-02
1H1	4	3336.00	0.39	1224.10	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.16E+00	1.33E+00	7.35E-01	8.02E-01	8.02E-01	2.21E-02
Light Cart NF-2	2	1668.00	1.02	1694.90	18	1.10E-01	8.00E-02	1.00E-02	1.00E-02	1.00E-02	7.18E-03	4.05E-01	2.94E-01	3.68E-02	3.68E-02	3.68E-02	2.64E-02
Air Compressor MC-1A	0.33	275.22	1.09	285.87	18.4	4.19E-01	2.67E-01	2.67E-01	7.10E-02	6.80E-02	8.00E-03	2.54E-01	1.62E-01	1.62E-01	4.31E-02	4.13E-02	4.85E-03
Total JP-8 AGE, Tons/year				hp-hrs	3949884.048							9.42E-02	1.35E-02	5.92E-03	4.00E-03	3.92E-03	1.07E-03

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.2-13. AGE HAP Emissions, McGuire, Baseline

Pollutant	JP-8 Emission Factors Turbine (lb/1000 gal)	JP-8 Emission Factors Reciprocating (lb/1000 hp-hr)	JP-8 Actual Annual Emissions (lbs/yr)	Gasoline Emission Factor (lb/MMBTU)	Gasoline Annual Emissions (lbs/yr)
Arsenic	1.53E-03				
Acetaldehyde		5.40E-03	2.13E+01	7.00E-02	
Acrolein		6.48E-04	2.56E+00		
Benzene	7.65E-03	6.50E-03	2.57E+01		
Beryllium	4.31E-05				
1,3-Butadiene	2.22E-03	2.74E-04	1.08E+00		
Cadmium	6.67E-04				
Chromium	1.53E-03				
Formaldehyde	3.89E-02	8.30E-03	3.28E+01		
Lead	1.95E-03				
Manganese	1.10E-01				
Mercury	1.67E-04				
Maphthalene	4.87E-03	5.94E-04	2.35E+00		
Nickel	6.39E-04				
POM	5.56E-03	1.20E-03	4.74E+00		
Selenium	3.48E-03				
Toluene		2.90E-03	1.15E+01		
Xylenes		2.00E-03	7.90E+00		
Total			9.68E-03		

Table D3.2-14. JP-8 AGE Equipment GHG Emissions, McGuire, Baseline

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/gal CO2	CH4	N2O	Annual Emissions (lbs/yr) CO2	CH4	N2O
KC-135 AGE											
Sorties:	834										
	Hours/Sortie										
Generator A/M32A-86	10	8340.00	6.47	69679.35	148	2.11E+01	5.91E-04	6.80E-04	1.47E+06	4.12E+01	4.74E+01
Start Cart A/M32A-60A	1	834.00	10.16	8474.52	180	2.11E+01	5.91E-04	6.80E-04	1.79E+05	5.01E+00	5.76E+00
Start Cart A/M32A-95	0.1	83.40	8.75	729.75	155	2.11E+01	5.91E-04	6.80E-04	1.54E+04	4.31E-01	4.96E-01
Heater/AC Ace 802-993 AC	10	8340.00	6.80	128059.35	272	2.11E+01	5.91E-04	6.80E-04	2.70E+06	7.57E+01	8.71E+01
MA-3C Air Conditioner	2	1668.00	7.12	11299.35	120	2.11E+01	5.91E-04	6.80E-04	2.38E+05	6.68E+00	7.68E+00
H1	5	4170.00	0.39	1530.12	6.5	2.11E+01	5.91E-04	6.80E-04	3.23E+04	9.04E-01	1.04E+00
1H1	4	3336.00	0.39	1224.10	6.5	2.11E+01	5.91E-04	6.80E-04	2.58E+04	7.23E-01	8.32E-01
Light Cart NF-2	2	1668.00	1.02	1694.90	18	2.11E+01	5.91E-04	6.80E-04	3.58E+04	1.00E+00	1.15E+00
Air Compressor MC-1A	0.33	275.22	1.09	285.87	18.4	2.11E+01	5.91E-04	6.80E-04	6.03E+03	1.69E-01	1.94E-01
Total JP-8 AGE, Metric Tons/year									2.13E+03	5.98E-02	6.88E-02

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.2-15. Aircraft Engine Emissions - Engine Tests, McGuire

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factors (lb/1000 lb fuel) VOC	CO	NOx	SO2	PM10	PM2.5	Emissions (lbs/yr) VOC	CO	NOx	SO2	PM10	PM2.5
KC-135																	
Defueling	21	Idle	0.50	1	1,014	2.1	30.7	4.0	1.1	0.1	0.1	22.40	326.79	42.58	11.28	1.30	1.30
Maintenance Run	83	Idle	0.33	4	1,014	2.1	30.7	4.0	1.1	0.1	0.1	236.10	3,444.22	448.76	118.92	13.67	13.67
TRT Run 2 Engine	10	Idle	0.17	2	1,014	2.1	30.7	4.0	1.1	0.1	0.1	7.11	103.74	13.52	3.58	0.41	0.41
	10	80% RPM	0.08	2	7801.2	0.0	0.1	18.5	1.1	0.1	0.1	0.60	1.17	240.54	13.78	1.43	1.43
TRT Run 4 Engine	7	Idle	0.17	4	1,014	2.1	30.7	4.0	1.1	0.1	0.1	9.96	145.24	18.92	5.01	0.58	0.58
	7	80% RPM	0.08	4	7801.2	0.0	0.1	18.5	1.1	0.1	0.1	0.84	1.64	336.75	19.29	2.00	2.00
												0.14	2.01	0.55	0.09	0.01	0.01

Table D3.2-16. HAP Emissions, Engine Tests, McGuire

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factor (lb/1000 lb fuel) (1) Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-135																			
Defueling	21	Idle	0.50	1	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Maintenance Run	83	Idle	0.33	4	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
TRT Run 2 Engine	10	Idle	0.17	2	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
	10	80% RPM	0.08	2	7801.2	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03
TRT Run 4 Engine	7	Idle	0.17	4	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
	7	80% RPM	0.08	4	7801.2	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03

Emissions, lbs/yr Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate	Total HAPs, TPY
1.01	0.00	0.00	0.03	0.02	0.10	0.01	0.02	0.02	0.02	0.01	0.01	0.72	0.05	
10.67	0.00	0.00	0.33	0.21	1.01	0.08	0.19	0.17	0.26	0.10	0.11	7.57	0.54	
0.32	0.00	0.00	0.01	0.01	0.03	0.00	0.01	0.01	0.01	0.00	0.00	0.23	0.02	
0.09	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.03	0.03	
0.45	0.00	0.00	0.01	0.01	0.04	0.00	0.01	0.01	0.01	0.00	0.00	0.32	0.02	
0.13	0.00	0.00	0.00	0.02	0.02	0.00	0.01	0.00	0.02	0.01	0.01	0.04	0.04	
0.00633576	0	0	0.000189869	0.00014172	0.0006046	4.4783E-05	0.00011327	9.6899E-05	0.000169651	6.50339E-05	7.09285E-05	0.00444994	0.0003553	0.01263775

Table D3.2-17. GHG Emissions, Engine Tests, McGuire

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factor(1) CO2 (lb/1000 lb fuel)	CH4 (lb/1000 lb fuel)	N2O (lb/1000 lb fuel)	Actual Emissions (lb/yr) CO2	CH4	N2O
KC-135											
Defueling	21	Idle	0.50	1	1,014	3,216.0	0.1	0.1	34,232.65	0.95	1.06
Maintenance Run	83	Idle	0.33	4	1,014	3,216.0	0.1	0.1	360,801.24	9.98	11.22
TRT Run 2 Engine	10	Idle	0.17	2	1,014	3,216.0	0.1	0.1	10,867.51	0.30	0.34
	10	80% RPM	0.08	2	7801.2	3,216.0	0.1	0.1	41,814.43	1.16	1.30
TRT Run 4 Engine	7	Idle	0.17	4	1,014	3,216.0	0.1	0.1	15,214.51	0.42	0.47
	7	80% RPM	0.08	4	7801.2	3,216.0	0.1	0.1	58,540.20	1.62	1.82
Total, tpy									237	0.01	0.01

(1) CO2 emission factors obtained from AFCEC 2013.
CH4 and N2O emission factors were derived from Table A-101 for jet fuel in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005, using density of JP-8 as 6.8 lb/gallon.

Table D3.2-18. Annual Worker Population and VMT at McGuire - KC-46A Project Scenarios

Scenario	Total # of Workers	Annual On-Base VMT	Annual Off-Base VMT
Existing	1051	273260	4560709.4
Proposed Action	1306	339560	5667256.4

[1]On-Base mileage based on 1.00 miles from 2009 AEI; assume 260 days/year

[2]Off-Base mileage based on distance to downtown Burlington, 16.69 miles; assume 260 days/year

Table D3.2-19. Annual Average On-Road Vehicle Emission Factors - McGuire

		Emission Factors (Grams/Mile)						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	0.587	9.65	0.442	0.007	0.025	0.011	368.1
LDDT	0.03	0.132	0.808	0.2	0.003	0.053	0.037	314
LDGT	60.32	0.826	11.45	0.694	0.01	0.025	0.011	516.1
LDDT	0.2	0.393	0.708	0.46	0.006	0.06	0.044	599.2
HDGV	0	1.081	28	1.201	0.017	0.049	0.032	905.3
HDDV	0	0.684	2.315	3.359	0.012	0.129	0.1	1245.6
MC	1.9	2.9	27.28	0.85	0.003	0.037	0.021	177.4
Proposed Action (Year 2018) (1)								
LDGV	37.55	0.446	8.78	0.316	0.007	0.025	0.011	368
LDDT	0.03	0.087	0.692	0.088	0.003	0.038	0.023	314.1
LDGT	60.32	0.664	10	0.521	0.01	0.025	0.011	516.6
LDDT	0.2	0.305	0.6	0.317	0.006	0.047	0.032	598.6
HDGV	0	0.784	26.32	0.677	0.017	0.04	0.025	904
HDDV	0	0.583	1.428	1.919	0.012	0.078	0.053	1245.9
MC	1.9	2.9	27.28	0.85	0.003	0.037	0.021	177.4

Notes: (1) Emission factors from AFCEC 2013, Table 5-13, for 2017 used to provide a conservative estimate of emissions for 2018

Table D3.2-20. Annual Average On-Base Vehicle Emissions

		Emissions, lbs/year						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	132.79	2182.98	99.99	1.58	5.66	2.49	83269.96
LDDT	0.03	0.02	0.15	0.04	0.00	0.01	0.01	56.75
LDGT	60.32	300.16	4160.82	252.19	3.63	9.08	4.00	187545.99
LDDT	0.2	0.47	0.85	0.55	0.01	0.07	0.05	721.96
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	33.19	312.26	9.73	0.03	0.42	0.24	2030.58
Total Existing, tons/year		0.23	3.33	0.18	0.00	0.01	0.00	136.81
Proposed Action (Year 2018) (1)								
LDGV	37.55	125.37	2468.07	88.83	1.97	7.03	3.09	103445.31
LDDT	0.03	0.02	0.16	0.02	0.00	0.01	0.01	70.54
LDGT	60.32	299.84	4515.59	235.26	4.52	11.29	4.97	233275.32
LDDT	0.2	0.46	0.90	0.47	0.01	0.07	0.05	896.23
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	41.25	388.02	12.09	0.04	0.53	0.30	2523.25
Total Proposed Action, tons/year		0.23	3.69	0.17	0.00	0.01	0.00	170.11

Table D3.2-21. Annual Average Off-Base Vehicle Emissions

		Emissions, lbs/year						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	3118.59	43229.91	2620.22	37.76	94.39	41.53	1948555.27
LDDT	0.03	1.19	2.14	1.39	0.02	0.18	0.13	1807.43
LDGT	60.32	6556.26	169819.79	7284.06	103.10	297.18	194.08	5490637.63
LDDT	0.2	13.75	46.55	67.55	0.24	2.59	2.01	25048.26
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	85.20	1677.32	60.37	1.34	4.78	2.10	70302.43
Total Existing, tons/year		4.89	107.39	5.02	0.07	0.20	0.12	3768.18
Proposed Action (Year 2018) (1)								
LDGV	37.55	3115.21	46915.82	2444.31	46.92	117.29	51.61	2423671.37
LDDT	0.03	1.14	2.25	1.19	0.02	0.18	0.12	2243.71
LDGT	60.32	5908.63	198361.15	5102.22	128.12	301.46	188.41	6813011.99
LDDT	0.2	14.57	35.68	47.95	0.30	1.95	1.32	31133.11
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total Proposed Action, tons/year		4.52	122.66	3.80	0.09	0.21	0.12	4635.03

Table D.2-22. Annual Air Operations for Aircraft at Forbes - Proposed Action

	Number of Operations		
Aircraft	LTO	TGO	Total
KC-46A	1508	7296	17608

Table D3.2-23. KC-46A Aircraft Closed Pattern Operations at Forbes - KC-46A Proposed Scenarios

	Operations/Year		Engine Setting/Time in Mode per Operation (Minutes)									
Scenario/Operation	Fraction of Ops	Total Ops per Pattern	48.5	52.5	55.0	57.5	58.5	60.0	60.5	62.5	70.5	75.0
CR01 IFR to RWY06 on South Side	0.0559	408	2.1406		8.5008		0.1362	2.0365	1.5710		0.7596	0.4919
CR02 TACAN RWY06 VFR Circle	0.0037	27	0.6319	0.8571	7.1268		0.1362	2.9128	1.5710		0.7596	0.4919
CR03 North Radar Track	0.0150	110	2.1406		5.0742		0.1362	1.6240	1.5710		0.7596	0.4919
CR04 Radar Track on 18C3	0.0063	46	2.1406		8.2663		0.1362	2.1209	1.5710		0.7596	0.4919
CR05 Radar Track on 18C4	0.0063	46	2.1406		6.8000		0.0681	2.1209	1.5710		0.7596	0.5567
CR06 Radar Track Continuous turn 150HDG to 90 HDG	0.0792	578	2.1406		7.4803		0.1362	2.1209	1.5712		0.7594	0.4919
CR07 Radar Track 150HDG for Crosswind	0.0150	110	2.1406		7.6444		0.1362	2.1209	1.5710		0.7596	0.4919
CR08 TACAN to Rwy 24 then VFR Circle to RWY 18	0.0075	55	0.6319	1.0058	7.2052	1.6424	0.1362	2.1650	1.5710		0.7596	0.4919
CR09 Radar track to North	0.0300	219	2.1406		6.5939		0.1362	3.9770	1.5710		0.7596	0.4919
CR10 Radar track on 36C3	0.0063	46	2.1406		7.3686		0.1362		3.6919		0.7596	0.4919
CR11 TACAN approach to RWY 36 VFR Circle to RWY 6	0.0063	46	0.6948	0.8238	7.2755	1.9866	0.1362	1.2953	1.5710		0.7596	0.4919
CV01 - North VFR	0.2135	1557	0.7645	1.1669	0.6817	0.9162	0.1362		0.7571		0.3668	0.4919
CV02 - West VFR on 18C2	0.0425	310	0.7645	1.1669	0.6817	0.9162	0.1362		0.7571		0.3668	0.4919
CV03 - North VFR Inside Housing	0.0502	366	0.7645	1.1669	0.7397	0.7516	0.1362		0.7571		0.3668	0.4919
CV04 - North VFR Outside Housing	0.3860	2816	0.7645	1.1669	0.9721	1.5196	0.0681		0.7571		0.3668	0.5567
CV05 - VFR With Breakout	0.0090	66	0.7645	1.1670	0.6680		0.1362	0.6419	0.7571	2.9350	0.3668	0.4919
CV06 - West VFR on 36C2	0.0675	493	0.7645	1.1669	0.7397	0.8613	0.1362		0.7571		0.3668	0.4919
Total Ops		7296										

Table D3.2-24. KC-46A Aircraft Closed Pattern Operations - Fuel Use and Emission Factors

			Engine Setting/Time in Mode per Operation (Minutes)									
Factor			48.5	52.5	55.0	57.5	58.5	60.0	60.5	62.5	70.5	75.0
Fuel Use, lbs/hr			19668.32	21455.2	22572	23688.8	24135.52	24805.6	24894.944	25922.4	29496.16	31506.4
Emission Factors, lbs/1000 lbs fuel												
VOC			0.0950	0.0932	0.0920	0.0909	0.0904	0.0897	0.0896	0.0886	0.0849	0.0828
CO			1.4009	1.2865	1.2150	1.1435	1.1149	1.0720	1.0663	1.0005	0.7717	0.6430
NOx			17.2797	18.3845	19.0750	19.7655	20.0417	20.4560	20.5112	21.1465	23.3561	24.5990
SO2			1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
PM10			0.0574	0.0590	0.0600	0.0610	0.0614	0.0620	0.0621	0.0630	0.0662	0.0680
PM2.5			0.0474	0.0490	0.0500	0.0510	0.0514	0.0520	0.0521	0.0530	0.0562	0.0580
CO2			3216	3216	3216	3216	3216	3216	3216	3216	3216	3216
CH4			0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
N2O			0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

Table D3.2-25. KC-46A Aircraft Closed Pattern Operations - Emissions Per Operation

Emissions per operation, lbs			VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
CR01 IFR to RWY06 on South Side			0.5528	6.9815	119.8938	6.4448	0.3705	0.3097	19553.2901	0.5411	0.6080
CR02 TACAN RWY06 VFR Circle			0.5193	6.4433	114.5336	6.0816	0.3516	0.2942	18451.2142	0.5106	0.5737
CR03 North Radar Track			0.4189	5.2325	91.8159	4.8976	0.2826	0.2364	14859.1404	0.4112	0.4620
CR04 Radar Track on 18C3			0.5478	6.9117	118.9246	6.3883	0.3673	0.3071	19381.7711	0.5364	0.6027
CR05 Radar Track on 18C4			0.4974	6.2328	108.6896	5.8105	0.3349	0.2801	17628.9690	0.4879	0.5482
CR06 Radar Track Continuous turn 150HDG to 90 HDG			0.5206	6.5524	113.2829	6.0748	0.3496	0.2923	18430.6441	0.5101	0.5731
CR07 Radar Track 150HDG for Crosswind			0.5263	6.6274	114.4612	6.1402	0.3533	0.2954	18629.2587	0.5155	0.5793
CR08 TACAN to Rwy 24 then VFR Circle to RWY 18			0.5582	6.9576	122.5660	6.5288	0.3769	0.3153	19808.1470	0.5482	0.6159
CR09 Radar track to North			0.5588	6.9699	122.6205	6.5348	0.3772	0.3155	19826.2219	0.5487	0.6165
CR10 Radar track on 36C3			0.5170	6.4998	112.5958	6.0336	0.3473	0.2904	18305.8273	0.5066	0.5692
CR11 TACAN approach to RWY 36 VFR Circle to RWY 6			0.5366	6.7049	117.5614	6.2726	0.3618	0.3027	19030.9306	0.5267	0.5918
CV01 - North VFR			0.1889	2.3143	42.1492	2.2192	0.1288	0.1079	6732.8662	0.1863	0.2094
CV02 - West VFR on 18C2			0.1889	2.3143	42.1492	2.2192	0.1288	0.1079	6732.8662	0.1863	0.2094
CV03 - North VFR Inside Housing			0.1850	2.2666	41.2817	2.1735	0.1262	0.1057	6594.1730	0.1825	0.2050
CV04 - North VFR Outside Housing			0.2210	2.7109	49.2300	2.5945	0.1505	0.1261	7871.7252	0.2178	0.2448
CV05 - VFR With Breakout			0.2917	3.4477	67.1451	3.4557	0.2028	0.1702	10484.5776	0.2902	0.3260
CV06 - West VFR on 36C2			0.1890	2.3161	42.1379	2.2194	0.1288	0.1079	6733.4865	0.1863	0.2094
Emissions, closed pattern ops, tons/year			1.0238	12.6852	226.0694	11.9930	0.6937	0.5806	36386.3482	1.0070	1.1314

Table D3.2-26. Annual Air Emissions for KC-46A Aircraft Operations at McGuire - Proposed Action

Aircraft	Annual Emissions, Tons/year								
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-46A LTOs	25.10	87.16	57.22	4.43	0.36	0.32	13441.53	0.37	0.42
KC-46A T&G	1.02	12.69	226.07	11.99	0.69	0.58	36386.35	1.01	1.13
APU	0.06	0.53	10.74	0.90	0.08	0.06	2194.71	0.00	0.00
Total Proposed Action	26.19	100.37	294.03	17.32	1.13	0.96	52022.59	1.38	1.55

Table D3.2-27. Annual HAP Emissions for KC-46A Aircraft Operations at McGuire - Proposed Action

Aircraft	Annual Emissions, Tons/year													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-46A LTOs	3.58	1.24	0.71	0.16	0.49	0.19	0.05	0.08	0.09	0.01	0.00	0.00	0.22	0.02
KC-46A Closed Pattern Ops	0.14	0.05	0.03	0.01	0.02	0.01	0.00	0.00	0.00	0.02	0.01	0.01	0.42	0.03
Total Proposed Action	3.72	1.29	0.74	0.16	0.51	0.19	0.05	0.09	0.09	0.03	0.01	0.01	0.65	0.05

Table D3.2-28. JP-8 AGE Equipment Emissions, Proposed Action, McGuire

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/hr NOx	CO	VOC	PM10	PM2.5	SO2	Annual Emissions (lbs/yr) NOx	CO	VOC	PM10	PM2.5	SO2
KC-46A AGE																	
Sorties:	1508																
	Hours/Sortie																
Generator A/M32A-86	10	15080.00	6.47	125990.97	148	6.10E+00	4.57E-01	2.94E-01	9.10E-02	8.90E-02	4.60E-02	2.03E+02	1.52E+01	9.77E+00	3.03E+00	2.96E+00	1.53E+00
Start Cart A/M32A-60A	1	1508.00	10.16	15323.23	180	1.82E+00	5.48E+00	2.70E-01	2.11E-01	2.05E-01	7.18E-02	6.05E+00	1.82E+01	8.98E-01	7.01E-01	6.82E-01	2.39E-01
Start Cart A/M32A-95	0.1	150.80	8.75	1319.50	155	1.47E+00	5.86E+00	7.00E-01	1.10E-01	1.07E-01	6.19E-02	4.89E-01	1.95E+00	2.33E-01	3.66E-02	3.56E-02	2.06E-02
Heater/AC Ace 802-993 AC	10	15080.00	6.80	231550.97	272	2.94E+00	1.50E-01	2.04E-01	1.98E-01	1.92E-01	4.80E-02	9.77E+01	4.99E+00	6.78E+00	6.58E+00	6.38E+00	1.60E+00
MA-3C Air Conditioner	2	3016.00	7.12	20430.97	120	4.17E+00	3.17E-01	5.30E-02	1.09E-01	1.05E-01	5.00E-02	2.77E+01	2.11E+00	3.52E-01	7.25E-01	6.98E-01	3.32E-01
H1	5	7540.00	0.39	2766.69	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	2.63E+00	3.01E+00	1.66E+00	1.81E+00	1.81E+00	4.99E-02
1H1	4	6032.00	0.39	2213.35	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	2.10E+00	2.41E+00	1.33E+00	1.45E+00	1.45E+00	3.99E-02
Light Cart NF-2	2	3016.00	1.02	3064.65	18	1.10E-01	8.00E-02	1.00E-02	1.00E-02	1.00E-02	7.18E-03	7.31E-01	5.32E-01	6.65E-02	6.65E-02	6.65E-02	4.78E-02
Air Compressor MC-1A	0.33	497.64	1.09	516.90	18.4	4.19E-01	2.67E-01	2.67E-01	7.10E-02	6.80E-02	8.00E-03	4.60E-01	2.93E-01	2.93E-01	7.79E-02	7.46E-02	8.78E-03
Total JP-8 AGE, Tons/year				hp-hrs	7141996.576							1.70E-01	2.43E-02	1.07E-02	7.24E-03	7.08E-03	1.93E-03

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.2-29. AGE HAP Emissions, Proposed Action, McGuire

Pollutant	JP-8 Emission Factors Turbine (lb/1000 gal)	JP-8 Emission Factors Reciprocating (lb/1000 hp-hr)	JP-8 Actual Annual Emissions (lbs/yr)	Gasoline Emission Factor (lb/MMBTU)	Gasoline Annual Emissions (lbs/yr)
Arsenic	1.53E-03				
Acetaldehyde		5.40E-03	3.86E+01	7.00E-02	
Acrolein		6.48E-04	4.63E+00		
Benzene	7.65E-03	6.50E-03	4.64E+01		
Beryllium	4.31E-05				
1,3-Butadiene	2.22E-03	2.74E-04	1.96E+00		
Cadmium	6.67E-04				
Chromium	1.53E-03				
Formaldehyde	3.89E-02	8.30E-03	5.93E+01		
Lead	1.95E-03				
Manganese	1.10E-01				
Mercury	1.67E-04				
Maphthalene	4.87E-03	5.94E-04	4.24E+00		
Nickel	6.39E-04				
POM	5.56E-03	1.20E-03	8.57E+00		
Selenium	3.48E-03				
Toluene		2.90E-03	2.07E+01		
Xylenes		2.00E-03	1.43E+01		
Total			1.75E-02		

Table D3.2-30. JP-8 AGE Equipment GHG Emissions, Proposed Action, McGuire

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/gal CO2	CH4	N2O	Annual Emissions (lbs/yr) CO2	CH4	N2O
KC-46A AGE											
Sorties:	1508										
	Hours/Sortie										
Generator A/M32A-86	10	15080.00	6.47	125990.97	148	2.11E+01	5.91E-04	6.80E-04	2.66E+06	7.45E+01	8.57E+01
Start Cart A/M32A-60A	1	1508.00	10.16	15323.23	180	2.11E+01	5.91E-04	6.80E-04	3.23E+05	9.06E+00	1.04E+01
Start Cart A/M32A-95	0.1	150.80	8.75	1319.50	155	2.11E+01	5.91E-04	6.80E-04	2.78E+04	7.80E-01	8.97E-01
Heater/AC Ace 802-993 AC	10	15080.00	6.80	231550.97	272	2.11E+01	5.91E-04	6.80E-04	4.89E+06	1.37E+02	1.57E+02
MA-3C Air Conditioner	2	3016.00	7.12	20430.97	120	2.11E+01	5.91E-04	6.80E-04	4.31E+05	1.21E+01	1.39E+01
H1	5	7540.00	0.39	2766.69	6.5	2.11E+01	5.91E-04	6.80E-04	5.84E+04	1.64E+00	1.88E+00
1H1	4	6032.00	0.39	2213.35	6.5	2.11E+01	5.91E-04	6.80E-04	4.67E+04	1.31E+00	1.51E+00
Light Cart NF-2	2	3016.00	1.02	3064.65	18	2.11E+01	5.91E-04	6.80E-04	6.47E+04	1.81E+00	2.08E+00
Air Compressor MC-1A	0.33	497.64	1.09	516.90	18.4	2.11E+01	5.91E-04	6.80E-04	1.09E+04	3.05E-01	3.51E-01
Total JP-8 AGE, Metric Tons/year									3.86E+03	1.08E-01	1.24E-01

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.2-31. Aircraft Engine Emissions - Engine Tests, Proposed Action, McGuire

						Emission Factors (lb/1000 lb fuel)						Emissions (lbs/yr)					
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	VOC	CO	NOx	SO2	PM10	PM2.5	VOC	CO	NOx	SO2	PM10	PM2.5
KC-46A																	
Defueling	44	Idle	0.50	1	1,663	12.5	42.6	3.8	1.1	0.1	0.1	456.98	1,559.12	138.31	38.79	4.02	3.66
Maintenance Run	175	Idle	0.33	2	1,663	12.5	42.6	3.8	1.1	0.1	0.1	2,423.37	8,268.04	733.47	205.68	21.34	19.40
TRT Run 1 Engine	20	Idle	0.17	1	1,663	12.5	42.6	3.8	1.1	0.1	0.1	69.24	236.23	20.96	5.88	0.61	0.55
	20	80% RPM	0.08	1	16869.6	0.1	0.5	26.0	1.1	0.1	0.1	2.26	14.06	730.45	29.80	1.97	1.69
TRT Run 2 Engine	15	Idle	0.17	2	1,663	12.5	42.6	3.8	1.1	0.1	0.1	103.86	354.34	31.43	8.81	0.91	0.83
	15	80% RPM	0.08	2	16869.6	0.1	0.5	26.0	1.1	0.1	0.1	3.40	21.09	1,095.68	44.70	2.95	2.53
												1.53	5.23	1.38	0.17	0.02	0.01

Table D3.2-32. HAP Emissions, Engine Tests, Proposed Action, McGuire

						Emission Factor (lb/1000 lb fuel) (1)													
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-46A																			
Defueling	44	Idle	0.50	1	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
Maintenance Run	175	Idle	0.33	2	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
TRT Run 2 Engine	20	Idle	0.17	1	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
	20	80% RPM	0.08	1	16869.6	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
TRT Run 4 Engine	15	Idle	0.17	2	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
	15	80% RPM	0.08	2	16869.6	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03

Emissions, lbs/yr														
Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate	Total HAPs, TPY
22.64	12.98	2.87	8.91	3.40	0.92	1.50	1.64	0.12	0.03	0.04	2.47	0.18	0.18	
120.09	68.85	15.21	47.27	18.05	4.90	7.93	8.70	0.64	0.18	0.19	13.10	0.94	0.94	
3.43	1.97	0.43	1.35	0.52	0.14	0.23	0.25	0.02	0.01	0.01	0.37	0.03	0.03	
0.32	0.11	0.06	0.01	0.04	0.02	0.00	0.01	0.01	0.05	0.02	0.01	1.42	0.07	
5.15	2.95	0.65	2.03	0.77	0.21	0.34	0.37	0.03	0.01	0.01	0.56	0.04	0.04	
0.48	0.17	0.10	0.02	0.07	0.03	0.01	0.01	0.01	0.07	0.03	0.02	2.13	0.11	
0.07605772	0.04351743	0.00966467	0.029796732	0.01142702	0.00310768	0.00500308	0.00548917	0.00041479	0.000173465	0.000146238	0.00826944	0.00237123	0.00068216	0.19612083

Table D3.2-33. GHG Emissions, Engine Tests, Proposed Action, McGuire

						Emission Factor(1)					
						CO2	CH4	N2O	Actual Emissions (lb/yr)		
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	(lb/1000 lb fuel)	(lb/1000 lb fuel)	(lb/1000 lb fuel)	CO2	CH4	N2O
KC-46A											
Defueling	44	Idle	0.50	1	1,663	3,216.0	0.1	0.1	117,674.73	3.26	3.66
Maintenance Run	175	Idle	0.33	2	1,663	3,216.0	0.1	0.1	624,032.64	17.27	19.40
TRT Run 2 Engine	20	Idle	0.17	1	1,663	3,216.0	0.1	0.1	17,829.50	0.49	0.55
	20	80% RPM	0.08	1	16869.6	3,216.0	0.1	0.1	90,421.06	2.50	2.81
TRT Run 4 Engine	15	Idle	0.17	2	1,663	3,216.0	0.1	0.1	26,744.26	0.74	0.83
	15	80% RPM	0.08	2	16869.6	3,216.0	0.1	0.1	135,631.58	3.75	4.22
Total, tpy									459	0.01	0.01

(1) CO2 emission factors obtained from AFCEC 2013.
CH4 and N2O emission factors were derived from Table A-101 for jet fuel in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005, using density of JP-8 as 6.8 lb/gallon.

Table D3.2-34. McGuire Comparison of Emissions

	Annual Emissions, Tons/year					
Baseline	VOC	CO	NOx	SO2	PM10	PM2.5
Aircraft Ops	3.21	49.03	83.34	7.43	0.39	0.39
AGE	0.01	0.01	0.09	0.00	0.00	0.00
Engine Tests	0.14	2.01	0.55	0.09	0.01	0.01
POVs	5.12	110.72	5.20	0.07	0.21	0.12
Total	8.48	161.78	89.18	7.59	0.61	0.53
Proposed Action	VOC	CO	NOx	SO2	PM10	PM2.5
Aircraft Ops	26.19	100.37	294.03	17.32	1.13	0.96
AGE	0.01	0.02	0.17	0.00	0.01	0.01
Engine Tests	1.53	5.23	1.38	0.17	0.02	0.01
POVs	4.75	126.34	3.97	0.09	0.22	0.12
Total	32.48	231.97	299.54	17.58	1.38	1.11
Net Increase	24.01	70.19	210.36	9.99	0.77	0.58

Table D3.2-35. McGuire Comparison of HAP Emissions

	Annual HAP Emissions, tons/year													
Baseline	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
Aircraft Ops	0.17	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.00	0.01	0.00	0.00	0.29	0.02
AGE	0.02	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Engine Tests	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.20	0.01	0.00	0.01	0.02	0.03	0.00	0.01	0.00	0.01	0.00	0.00	0.29	0.02
Proposed Action	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
Aircraft Ops	3.72	1.29	0.74	0.16	0.51	0.19	0.05	0.09	0.09	0.03	0.01	0.01	0.65	0.05
AGE	0.03	0.02	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Engine Tests	0.08	0.04	0.01	0.03	0.01	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00
Total	3.83	1.35	0.75	0.20	0.54	0.20	0.06	0.09	0.09	0.03	0.01	0.02	0.65	0.05
Net Increase	3.63	1.34	0.75	0.19	0.52	0.17	0.06	0.08	0.09	0.02	0.01	0.01	0.36	0.03

Table D3.2-36. McGuire Comparison of GHG Emissions

	Annual GHG Emissions, metric tons/year			
Baseline	CO2	CH4	N2O	CO2e
Aircraft Ops	20450	0.57	0.64	20659
AGE	2134	0.06	0.07	2157
Engine Tests	237	0.01	0.01	239
POVs	3543	0.00	0.00	3543
Total	26363	0.63	0.71	26597
Proposed Action	CO2	CH4	N2O	
Aircraft Ops	47195	1.25	1.41	47657
AGE	3859	0.11	0.12	3900
Engine Tests	459	0.01	0.01	464
POVs	4359	0.00	0.00	4359
Total	55872	1.37	1.54	56379
Net Increase	29509	0.74	0.83	29782

Table D3.3-1 Engine Emission Factors by Throttle Setting - KC-135 and KC-46A Aircraft

Engine Type/Throttle Setting	Fuel Flow (Pounds/Hour)	Emission Factors, lbs/1000 lbs fuel								
		VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
F-108-CF-100 (2)										
Idle	1013.76	2.1045	30.7	4	1.06	0.06	0.06	3216	8.90E-02	1.00E-01
Approach	2463.12	0.092	4.2	8.2	1.06	0.06	0.06	3216	8.90E-02	1.00E-01
Intermediate	6486.48	0.0575	0.09	16	1.06	0.05	0.05	3216	8.90E-02	1.00E-01
Military	7801.2	0.046	0.09	18.5	1.06	0.07	0.07	3216	8.90E-02	1.00E-01
P&W 4062 (3)										
Idle	1663.2	12.489	42.61	3.78	1.06	0.11	0.1	3216	8.90E-02	1.00E-01
Approach	5702.4	0.1035	1.93	12.17	1.06	0.05	0.04	3216	8.90E-02	1.00E-01
Climbout	16869.6	0.0805	0.5	25.98	1.06	0.07	0.06	3216	8.90E-02	1.00E-01
Take-Off	21621.6	0.092	0.61	34.36	1.06	0.08	0.07	3216	8.90E-02	1.00E-01
		Emissions, Pounds/Hour								
APU Use - P&W 4062		0.04	0.33	6.72	0.56	0.05	0.04	1373		

Notes: (1) Data are for one engine. The KC-135R has 4 engines and the KC-46A has 2 engines.
(2) Data from *Air Emissions Factor Guide to Air Force Mobile Sources* (AFCEC 2013).
(3) ICAO Engine Exhaust Emissions Data Bank - Subsonic Engines - (ICAO 2013).

Table D3.3-2. HAP Emission Factors - KC-135 and KC-46A Aircraft

Engine Type	Emission Factor (lb/1000 lb fuel) (1)													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
F108-CF-100														
Idle	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Approach	1.50E-02	0.00E+00	0.00E+00	0.00E+00	3.22E-03	6.23E-03	5.53E-04	1.61E-03	0.00E+00	1.85E-03	8.63E-04	7.63E-04	4.46E-02	3.81E-03
Intermediate	5.58E-03	0.00E+00	0.00E+00	0.00E+00	4.25E-04	1.42E-03	0.00E+00	5.42E-04	0.00E+00	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
Military	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03
P&W 4062 (3)														
Idle	1.78E+00	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Approach	1.48E-02	5.13E-03	2.94E-03	6.50E-04	2.02E-03	7.71E-04	2.09E-04	3.39E-04	3.71E-04	1.85E-03	8.63E-04	7.63E-04	4.46E-02	3.81E-03
Intermediate	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
Military	1.31E-02	4.56E-03	2.61E-03	5.78E-04	1.79E-03	6.85E-04	1.86E-04	3.01E-04	3.30E-04	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03

Notes: (1) Data are for one engine. The KC-135R has 4 engines and the KC-46A has 2 engines.
(2) Data from *Air Emissions Factor Guide to Air Force Mobile Sources* (AFCEC 2013), Table 2-9.

Table D3.3-3. Land and Take-off/Touch and Go Times in Mode and Fuel Usages - KC-135 and KC-46A Aircraft

	LTO			Touch & Go	
	Time in Mode (TIM)		Fuel Usage	TIM	Fuel Usage
Aircraft/Mode (Engine Throttle Setting)	Minutes	Hours	Pounds	Hours	Pounds
KC-135 (2)					
Taxi Out (Idle)	32.8	0.55	2217		
Take-off (Military)	0.7	0.01	364	0.01	364
Climbout (Intermediate)	2.5	0.04	1081	0.04	1081
Approach	5.2	0.09	854	0.09	854
Taxi In (Idle)	14.9	0.25	1007		
Totals	56.1	0.94	5523	0.14	2299
KC-46A (2)					
Taxi Out (Idle)	32.8	0.55	1818		
Take-off (Military)	0.7	0.01	505	0.01	505
Climbout (Intermediate)	2.5	0.04	1406	0.04	1406
Approach	5.2	0.09	988	0.09	988
Taxi In (Idle)	14.9	0.25	826		
Totals	56.1	0.94	5543	0.14	2899
APU Use, KC-46A (3)		Hours			
Pre-Flight - OBIGGS + Electric + Max ECS		1.50			
Pre-Flight - Main Engine Start + Electric		0.03			
Post-Flight - Electric + Min ECS		0.58			
Total Hours per LTO		2.12			

Notes: (1) Fuel usage per aircraft.

(2) TIM Data from Table 2-4, Transport Aircraft (AFCEC 2013).

(3) APU use from FTU/MOB1 Draft EIS.

Table D3.3-4. Land and Take-off/Touch and Go Total Fuel Usages and Emissions - KC-135 and KC-46A Aircraft

Aircraft/Mode	LTO			Emissions (Pounds)								
LTOs	Time in Mode (TIM)		Fuel Usage	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
	Minutes	Hours	Pounds									
KC-135 (2)												
Taxi Out (Idle)	32.8	0.55	2217	4.67	68.05	8.87	2.35	0.13	0.13	7129.08	0.20	0.22
Take-off (Military)	0.7	0.01	364	0.02	0.03	6.74	0.39	0.03	0.03	1170.80	0.03	0.04
Climbout (Intermediate)	2.5	0.04	1081	0.06	0.10	17.30	1.15	0.05	0.05	3476.75	0.10	0.11
Approach	5.2	0.09	854	0.08	3.59	7.00	0.91	0.05	0.05	2746.08	0.08	0.09
Taxi In (Idle)	14.9	0.25	1007	2.12	30.91	4.03	1.07	0.06	0.06	3238.52	0.09	0.10
Totals	56.1	0.935	5523	6.94	102.69	43.93	5.85	0.32	0.32	17761.24	0.49	0.55
KC-46A (2)												
Taxi Out (Idle)	32.8	0.55	1818	22.71	77.48	6.87	1.93	0.20	0.18	5848.08	0.16	0.18
Take-off (Military)	0.7	0.01	505	0.05	0.31	17.33	0.53	0.04	0.04	1622.48	0.04	0.05
Climbout (Intermediate)	2.5	0.04	1406	0.11	0.70	36.52	1.49	0.10	0.08	4521.05	0.13	0.14
Approach	5.2	0.09	988	0.10	1.91	12.03	1.05	0.05	0.04	3178.75	0.09	0.10
Taxi In (Idle)	14.9	0.25	826	10.32	35.20	3.12	0.88	0.09	0.08	2656.60	0.07	0.08
Totals	56.1	0.935	5543	33.29	115.60	75.88	5.88	0.48	0.42	17826.96	0.49	0.55

Aircraft/Mode	Touch and Go			Emissions (Pounds)								
Touch and Go	Time in Mode (TIM)		Fuel Usage	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
	Minutes	Hours	Pounds									
KC-135 (2)												
Take-off (Military)	0.70	0.01	364	0.02	0.03	6.74	0.39	0.03	0.03	1170.80	0.03	0.04
Climbout (Intermediate)	2.50	0.04	1081	0.06	0.10	17.30	1.15	0.05	0.05	3476.75	0.10	0.11
Approach	5.20	0.09	854	0.08	3.59	7.00	0.91	0.05	0.05	2746.08	0.08	0.09
Totals	8.40	0.14	2299	0.16	3.72	31.03	2.44	0.13	0.13	7393.64	0.20	0.23
KC-46A (2)												
Take-off (Military)	0.7	0.01	505	0.05	0.31	17.33	0.53	0.04	0.04	1622.48	0.04	0.05
Climbout (Intermediate)	2.5	0.04	1406	0.11	0.70	36.52	1.49	0.10	0.08	4521.05	0.13	0.14
Approach	5.2	0.09	988	0.10	1.91	12.03	1.05	0.05	0.04	3178.75	0.09	0.10
Totals	8.40	0.14	2899	0.26	2.92	65.89	3.07	0.19	0.16	9322.28	0.26	0.29

Table D3.3-5. Land and Take-off/Touch and Go Total Fuel Usages and HAP Emissions - KC-135 and KC-46A Aircraft

Aircraft/Mode	LTO			Emissions (Pounds)													
LTOs	Time in Mode (TIM)		Fuel Usage	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
	Minutes	Hours	Pounds														
KC-135 (2)																	
Taxi Out (Idle)	32.8	0.55	2217	0.21	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.15	0.01
Take-off (Military)	0.7	0.01	364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1081	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Approach	5.2	0.09	854	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Taxi In (Idle)	14.9	0.25	1007	0.10	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Totals	56.1	0.94	5523	0.33	0.00	0.00	0.01	0.01	0.04	0.00	0.01	0.00	0.01	0.00	0.00	0.31	0.02
KC-46A (2)																	
Taxi Out (Idle)	32.8	0.55	1818	3.24	1.13	0.65	0.14	0.44	0.17	0.05	0.07	0.08	0.01	0.00	0.00	0.12	0.01
Take-off (Military)	0.7	0.01	505	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1406	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Approach	5.2	0.09	988	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Taxi In (Idle)	14.9	0.25	826	1.47	0.51	0.29	0.06	0.20	0.08	0.02	0.03	0.04	0.00	0.00	0.00	0.06	0.00
Totals	56.1	0.94	5543	4.75	1.65	0.95	0.21	0.65	0.25	0.07	0.11	0.12	0.01	0.00	0.00	0.29	0.02

Aircraft/Mode	Touch and Go			Emissions (Pounds)													
Touch and Go	Time in Mode (TIM)		Fuel Usage	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
	Minutes	Hours	Pounds														
KC-135 (2)																	
Take-off (Military)	0.70	0.01	364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.50	0.04	1081	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Approach	5.20	0.09	854	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Totals	8.40	0.14	2299	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.01
KC-46A (2)																	
Take-off (Military)	0.7	0.01	505	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1406	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Approach	5.2	0.09	988	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Totals	8.40	0.14	2899	0.04	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.01

Table D3.3-6. Annual Air Operations for Aircraft at Pease - Baseline

	Number of Operations		
Aircraft	LTO	TGO	Total
KC-135	614	2456	6140

Table D3.3-7. KC-135 AirCraft Closed Pattern Operations at Pease

Scenario/Operation	Operations/Year		Engine Setting/Time in Mode per Operation (Minutes)						
	Fraction of Ops	Total Ops per Pattern	55%	58%	60%	70%	73%	85%	
KC-135 VFR Profile	0.6225	1529	1.08073231	1.05954148	3.23876605	0.6250811	0.10721551	0.60319134	6.7145
KC-135 IFR Profile	0.3775	927	5.90400061	2.76893508	3.98841687	0.45137435	0.10721551	0.60319134	13.8231
Total Ops		2456							

Table D3.3-8. KC-135 Aircraft Closed Pattern Operations - Fuel Use and Emission Factors, Baseline

Factor			Engine Setting/Time in Mode per Operation (Minutes)					
			55%	58%	60%	70%	73%	85%
Fuel Use, lbs/hr			19910.88	20916.72	21922.56	25945.92	27589.32	31204.8
Emission Factors, lbs/1000 lbs fuel								
VOC			0.0704	0.0683	0.0661	0.0575	0.0539	0.0460
CO			1.6313	1.3744	1.1175	0.0900	0.0900	0.0900
NOx			13.0750	13.5625	14.0500	16.0000	16.7813	18.5000
SO2			1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
PM10			0.0538	0.0531	0.0525	0.0500	0.0563	0.0700
PM2.5			0.0538	0.0531	0.0525	0.0500	0.0563	0.0700
CO2			3216	3216	3216	3216	3216	3216
CH4			0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
N2O			0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

Table D3.3-9. KC-135 Aircraft Closed Pattern Operations - Emissions Per Operation, Baseline

Emissions per operation, lbs			VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-135 CA VFR Right Turns South Side			0.1614	2.4721	37.2809	2.6974	0.1393	0.1393	8183.7166	0.2265	0.2545
KC-135 CC IFR Right Turns Southwest Side			0.3286	6.2014	68.9372	5.2364	0.2676	0.2676	15886.9857	0.4397	0.4940
Emissions, closed pattern ops, tons/year			0.2757	4.7645	60.4558	4.4894	0.2305	0.2305	13620.6084	0.3769	0.4235

Table D3.3-10. Annual Air Emissions for KC-135 Aircraft Operations at Pease - Baseline

Aircraft	Annual Emissions, Tons/year								
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-135 LTOs	2.13	31.52	13.49	1.80	0.10	0.10	5452.70	0.15	0.17
KC-135 T&G	0.28	4.76	60.46	4.49	0.23	0.23	13620.61	0.38	0.42
Total Existing	2.41	36.29	73.94	6.29	0.33	0.33	19073.31	0.53	0.59

Table D3.3-11. Annual HAP Emissions for KC-135 Aircraft Operations at Pease - Baseline

Aircraft	Annual Emissions, Tons/year													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-135 LTOs	0.10	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.10	0.01
KC-135 Closed Pattern Ops	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.11	0.01
Total Existing	0.13	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.21	0.02

Table D3.3-12. JP-8 AGE Equipment Emissions, Pease, Baseline

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/hr NOx	CO	VOC	PM10	PM2.5	SO2	Annual Emissions (lbs/yr) NOx	CO	VOC	PM10	PM2.5	SO2
KC-135 AGE																	
Sorties:	614																
	Hours/Sortie																
Generator A/M32A-86	10	6140.00	6.47	51298.71	148	6.10E+00	4.57E-01	2.94E-01	9.10E-02	8.90E-02	4.60E-02	8.26E+01	6.19E+00	3.98E+00	1.23E+00	1.20E+00	6.23E-01
Start Cart A/M32A-60A	1	614.00	10.16	6239.03	180	1.82E+00	5.48E+00	2.70E-01	2.11E-01	2.05E-01	7.18E-02	2.46E+00	7.42E+00	3.65E-01	2.86E-01	2.77E-01	9.72E-02
Start Cart A/M32A-95	0.1	61.40	8.75	537.25	155	1.47E+00	5.86E+00	7.00E-01	1.10E-01	1.07E-01	6.19E-02	1.99E-01	7.93E-01	9.48E-02	1.49E-02	1.45E-02	8.37E-03
Heater/AC Ace 802-993 AC	10	6140.00	6.80	94278.71	272	2.94E+00	1.50E-01	2.04E-01	1.98E-01	1.92E-01	4.80E-02	3.98E+01	2.03E+00	2.76E+00	2.68E+00	2.60E+00	6.50E-01
MA-3C Air Conditioner	2	1228.00	7.12	8318.71	120	4.17E+00	3.17E-01	5.30E-02	1.09E-01	1.05E-01	5.00E-02	1.13E+01	8.58E-01	1.43E-01	2.95E-01	2.84E-01	1.35E-01
H1	5	3070.00	0.39	1126.49	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.07E+00	1.23E+00	6.77E-01	7.38E-01	7.38E-01	2.03E-02
1H1	4	2456.00	0.39	901.19	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	8.56E-01	9.80E-01	5.41E-01	5.90E-01	5.90E-01	1.62E-02
Light Cart NF-2	2	1228.00	1.02	1247.81	18	1.10E-01	8.00E-02	1.00E-02	1.00E-02	1.00E-02	7.18E-03	2.98E-01	2.17E-01	2.71E-02	2.71E-02	2.71E-02	1.94E-02
Air Compressor MC-1A	0.33	202.62	1.09	210.46	18.4	4.19E-01	2.67E-01	2.67E-01	7.10E-02	6.80E-02	8.00E-03	1.87E-01	1.19E-01	1.19E-01	3.17E-02	3.04E-02	3.57E-03
Total JP-8 AGE, Tons/year				hp-hrs	2907948.208							6.94E-02	9.91E-03	4.35E-03	2.95E-03	2.88E-03	7.86E-04

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.3-13. AGE HAP Emissions, Pease, Baseline

Pollutant	JP-8 Emission Factors Turbine (lb/1000 gal)	JP-8 Emission Factors Reciprocating (lb/1000 hp-hr)	JP-8 Actual Annual Emissions (lbs/yr)	Gasoline Emission Factor (lb/MMBTU)	Gasoline Annual Emissions (lbs/yr)
Arsenic	1.53E-03				
Acetaldehyde		5.40E-03	1.57E+01	7.00E-02	
Acrolein		6.48E-04	1.88E+00		
Benzene	7.65E-03	6.50E-03	1.89E+01		
Beryllium	4.31E-05				
1,3-Butadiene	2.22E-03	2.74E-04	7.97E-01		
Cadmium	6.67E-04				
Chromium	1.53E-03				
Formaldehyde	3.89E-02	8.30E-03	2.41E+01		
Lead	1.95E-03				
Manganese	1.10E-01				
Mercury	1.67E-04				
Maphthalene	4.87E-03	5.94E-04	1.73E+00		
Nickel	6.39E-04				
POM	5.56E-03	1.20E-03	3.49E+00		
Selenium	3.48E-03				
Toluene		2.90E-03	8.43E+00		
Xylenes		2.00E-03	5.82E+00		
Total			7.12E-03		

Table D3.3-14. JP-8 AGE Equipment GHG Emissions, Pease, Baseline

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/gal CO2	CH4	N2O	Annual Emissions (lbs/yr) CO2	CH4	N2O
KC-135 AGE											
Sorties:	614										
	Hours/Sortie										
Generator A/M32A-86	10	6140.00	6.47	51298.71	148	2.11E+01	5.91E-04	6.80E-04	1.08E+06	3.03E+01	3.49E+01
Start Cart A/M32A-60A	1	614.00	10.16	6239.03	180	2.11E+01	5.91E-04	6.80E-04	1.32E+05	3.69E+00	4.24E+00
Start Cart A/M32A-95	0.1	61.40	8.75	537.25	155	2.11E+01	5.91E-04	6.80E-04	1.13E+04	3.18E-01	3.65E-01
Heater/AC Ace 802-993 AC	10	6140.00	6.80	94278.71	272	2.11E+01	5.91E-04	6.80E-04	1.99E+06	5.57E+01	6.41E+01
MA-3C Air Conditioner	2	1228.00	7.12	8318.71	120	2.11E+01	5.91E-04	6.80E-04	1.76E+05	4.92E+00	5.66E+00
H1	5	3070.00	0.39	1126.49	6.5	2.11E+01	5.91E-04	6.80E-04	2.38E+04	6.66E-01	7.66E-01
1H1	4	2456.00	0.39	901.19	6.5	2.11E+01	5.91E-04	6.80E-04	1.90E+04	5.33E-01	6.13E-01
Light Cart NF-2	2	1228.00	1.02	1247.81	18	2.11E+01	5.91E-04	6.80E-04	2.63E+04	7.37E-01	8.49E-01
Air Compressor MC-1A	0.33	202.62	1.09	210.46	18.4	2.11E+01	5.91E-04	6.80E-04	4.44E+03	1.24E-01	1.43E-01
Total JP-8 AGE, Metric Tons/year									1.57E+03	4.40E-02	5.06E-02

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.3-15. Aircraft Engine Emissions - Engine Tests, Pease, Baseline

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factors (lb/1000 lb fuel) VOC	CO	NOx	SO2	PM10	PM2.5	Emissions (lbs/yr) VOC	CO	NOx	SO2	PM10	PM2.5
KC-135																	
Defueling	15	Idle	0.50	1	1,014	2.1	30.7	4.0	1.1	0.1	0.1	16.00	233.42	30.41	8.06	0.46	0.46
Maintenance Run	61	Idle	0.33	4	1,014	2.1	30.7	4.0	1.1	0.1	0.1	173.52	2,531.29	329.81	87.40	4.95	4.95
TRT Run 2 Engine	7	Idle	0.17	2	1,014	2.1	30.7	4.0	1.1	0.1	0.1	4.98	72.62	9.46	2.51	0.14	0.14
	7	80% RPM	0.08	2	7801.2	0.0	0.1	18.5	1.1	0.1	0.1	0.42	0.82	168.38	9.65	1.00	1.00
TRT Run 4 Engine	5	Idle	0.17	4	1,014	2.1	30.7	4.0	1.1	0.1	0.1	7.11	103.74	13.52	3.58	0.20	0.20
	5	80% RPM	0.08	4	7801.2	0.0	0.1	18.5	1.1	0.1	0.1	0.60	1.17	240.54	13.78	1.43	1.43
												0.10	1.47	0.40	0.06	0.00	0.00

Table D3.3-16. HAP Emissions, Engine Tests, Pease, Baseline

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factor (lb/1000 lb fuel) (1) Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-135																			
Defueling	15	Idle	0.50	1	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Maintenance Run	61	Idle	0.33	4	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
TRT Run 2 Engine	7	Idle	0.17	2	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
	7	80% RPM	0.08	2	7801.2	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03
TRT Run 4 Engine	5	Idle	0.17	4	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
	5	80% RPM	0.08	4	7801.2	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03

Emissions, lbs/yr Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate	Total HAPs, TPY
0.72	0.00	0.00	0.02	0.01	0.07	0.01	0.01	0.01	0.02	0.01	0.01	0.51	0.04	
7.84	0.00	0.00	0.24	0.16	0.74	0.06	0.14	0.12	0.19	0.08	0.08	5.57	0.40	
0.22	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.16	0.01	
0.06	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.02	
0.32	0.00	0.00	0.01	0.01	0.03	0.00	0.01	0.01	0.01	0.00	0.00	0.23	0.02	
0.09	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.02	0.00	0.01	0.03	0.03	
0.00463278	0	0	0.00013891	0.00010328	0.00044193	3.2764E-05	8.2749E-05	7.0892E-05	0.00012369	4.74573E-05	5.17164E-05	0.00325492	0.00025906	0.00924015

Table D3.3-17. GHG Emissions, Engine Tests, Pease, Baseline

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factor(1) CO2 (lb/1000 lb fuel)	CH4 (lb/1000 lb fuel)	N2O (lb/1000 lb fuel)	Actual Emissions (lb/yr) CO2	CH4	N2O
KC-135											
Defueling	15	Idle	0.50	1	1,014	3,216.0	0.1	0.1	24,451.89	0.68	0.76
Maintenance Run	61	Idle	0.33	4	1,014	3,216.0	0.1	0.1	265,167.18	7.34	8.25
TRT Run 2 Engine	7	Idle	0.17	2	1,014	3,216.0	0.1	0.1	7,607.26	0.21	0.24
	7	80% RPM	0.08	2	7801.2	3,216.0	0.1	0.1	29,270.10	0.81	0.91
TRT Run 4 Engine	5	Idle	0.17	4	1,014	3,216.0	0.1	0.1	10,867.51	0.30	0.34
	5	80% RPM	0.08	4	7801.2	3,216.0	0.1	0.1	41,814.43	1.16	1.30
Total, tpy									172	0.00	0.01

(1) CO2 emission factors obtained from AFCEC 2013.
CH4 and N2O emission factors were derived from Table A-101 for jet fuel in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005, using density of JP-8 as 6.8 lb/gallon.

Table D3.3-18. Annual Worker Population and VMT at Pease - KC-46A Project Scenarios

Scenario	Total # of Workers	Annual On-Base VMT	Annual Off-Base VMT
Existing	1099	285740	1028664
Proposed Action	1227	319020	1148472

[1]On-Base mileage based on 1.00 miles from 2009 AEI; assume 260 days/year

[2]Off-Base mileage based on distance to downtown Portsmouth, 3.60 miles; assume 260 days/year

Table D3.3-19. Annual Average On-Road Vehicle Emission Factors - Pease

		Emission Factors (Grams/Mile)						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	0.567	11.64	0.455	0.007	0.025	0.011	368.1
LDDT	0.03	0.132	0.808	0.2	0.003	0.053	0.037	314
LDGT	60.32	0.825	13.66	0.728	0.01	0.025	0.011	516.1
LDDT	0.2	0.393	0.708	0.46	0.006	0.06	0.044	599.2
HDGV	0	1.021	29.59	1.222	0.017	0.049	0.032	905.3
HDDV	0	0.684	2.315	3.359	0.012	0.129	0.1	1245.6
MC	1.9	2.73	28.73	0.9	0.003	0.037	0.021	177.4
Proposed Action (Year 2018) (1)								
LDGV	37.55	0.432	10.69	0.324	0.007	0.025	0.011	368
LDDT	0.03	0.087	0.692	0.088	0.003	0.038	0.023	314.1
LDGT	60.32	0.662	11.91	0.545	0.01	0.025	0.011	516.6
LDDT	0.2	0.305	0.6	0.317	0.006	0.047	0.032	598.6
HDGV	0	0.739	27.82	0.689	0.017	0.04	0.025	904
HDDV	0	0.583	1.428	1.919	0.012	0.078	0.053	1245.9
MC	1.9	2.73	28.73	0.9	0.003	0.037	0.021	177.4

Notes: (1) Emission factors from AFCEC 2013, Table 5-13, for 2017 used to provide a conservative estimate of emissions for 2018

Table D3.3-20. Annual Average On-Base Vehicle Emissions, Pease

		Emissions, lbs/year						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	134.12	2753.41	107.63	1.66	5.91	2.60	87072.96
LDDT	0.03	0.02	0.15	0.04	0.00	0.01	0.01	59.34
LDGT	60.32	313.49	5190.62	276.63	3.80	9.50	4.18	196111.36
LDDT	0.2	0.50	0.89	0.58	0.01	0.08	0.06	754.93
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	32.68	343.87	10.77	0.04	0.44	0.25	2123.32
Total Existing, tons/year		0.24040363	4.14447428	0.19782454	0.00274987	0.00797091	0.00354783	143.060961
Proposed Action (Year 2018) (1)								
LDGV	37.55	114.09	2823.20	85.57	1.85	6.60	2.91	97187.90
LDDT	0.03	0.02	0.15	0.02	0.00	0.01	0.00	66.27
LDGT	60.32	280.85	5052.75	231.21	4.24	10.61	4.67	219164.48
LDDT	0.2	0.43	0.84	0.45	0.01	0.07	0.05	842.02
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	36.48	383.92	12.03	0.04	0.49	0.28	2370.62
Total Proposed Action, tons/year		0.21593421	4.13043111	0.16463595	0.00307014	0.00888855	0.00395112	159.815646

Table D3.3-21. Annual Average Off-Base Vehicle Emissions, Pease

		Emissions, lbs/year						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	482.84	9912.27	387.46	5.96	21.29	9.37	313462.67
LDDT	0.03	0.09	0.55	0.14	0.00	0.04	0.03	213.63
LDGT	60.32	1128.56	18686.25	995.87	13.68	34.20	15.05	706000.91
LDDT	0.2	1.78	3.21	2.09	0.03	0.27	0.20	2717.76
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	117.63	1237.94	38.78	0.13	1.59	0.90	7643.94
Total Existing, tons/year		0.86545308	14.9201074	0.71216834	0.00989952	0.02869528	0.01277218	515.019458
Proposed Action (Year 2018) (1)								
LDGV	37.55	367.88	9103.28	275.91	5.96	21.29	9.37	313377.51
LDDT	0.03	0.06	0.47	0.06	0.00	0.03	0.02	213.70
LDGT	60.32	905.59	16292.33	745.53	13.68	34.20	15.05	706684.89
LDDT	0.2	1.38	2.72	1.44	0.03	0.21	0.15	2715.04
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	117.63	1237.94	38.78	0.13	1.59	0.90	7643.94
Total Proposed Action, tons/year		0.69626905	13.3183681	0.53086038	0.00989952	0.02866069	0.0127402	515.317541

Table D3.3-22. Annual Air Operations for Aircraft at Pease - Proposed Action

	Number of Operations		
Aircraft	LTO	TGO	Total
KC-46A	884	3536	8840

Table D3.3-23. KC-46A Aircraft Closed Pattern Operations at Forbes - KC-46A Proposed Scenarios

Scenario/Operation	Operations/Year		Engine Setting/Time in Mode per Operation (Minutes)						
	Fraction of Ops	Total Ops per Pattern	55%	58%	60%	68%	73%	83%	85%
KC-46A VFR Profile	0.8924	3156	1.52770185	1.04541426	2.57545944	0.66856113	0.06861792	0.3602441	0.39626852
KC-46A IFR Profile	0.1076	380	5.24755579	1.580018	4.11836013	1.16386557	0.06861792	0.39455307	0.33222512
Total Ops		3536							

Table D3.3-24. KC-46A Aircraft Closed Pattern Operations - Fuel Use and Emission Factors

Factor			Engine Setting/Time in Mode per Operation (Minutes)						
			55%	58%	60%	68%	73%	83%	85%
Fuel Use, lbs/hr			22572	23688.8	24805.6	28379.36	30389.6	34928	36116
Emission Factors, lbs/1000 lbs									
VOC			0.0920	0.0909	0.0897	0.0860	0.0840	0.0819	0.0834
CO			1.2150	1.1435	1.0720	0.8432	0.7145	0.5138	0.5275
NOx			19.0750	19.7655	20.4560	22.6656	23.9085	27.0275	28.0750
SO2			1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
PM10			0.0600	0.0610	0.0620	0.0652	0.0670	0.0713	0.0725
PM2.5			0.0500	0.0510	0.0520	0.0552	0.0570	0.0613	0.0625
CO2			3216	3216	3216	3216	3216	3216	3216
CH4			0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
N2O			0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

Table D3.3-25. KC-46A Aircraft Closed Pattern Operations - Emissions Per Operation

Emissions per operation, lbs			VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-46A CA VFR Right Turns South Side			0.2531	2.8367	61.2646	3.0225	0.1809	0.1523	9170.2396	0.2538	0.2851
KC-46A CC IFR Right Turns Southwest Side			0.4768	5.6496	109.9461	5.6344	0.3311	0.2780	17094.6253	0.4731	0.5315
Emissions, closed pattern ops, tons/year			0.4900	5.5504	117.5768	5.8407	0.3483	0.2932	17720.4935	0.4904	0.5510

Table D3.3-26. Annual Air Emissions for KC-46A Aircraft Operations at Pease - Proposed Action

Aircraft	Annual Emissions, Tons/year								
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-46A LTOs	14.71	51.10	33.54	2.60	0.21	0.19	7879.51	0.22	0.25
KC-46A T&G	0.49	5.55	117.58	5.84	0.35	0.29	17720.49	0.49	0.55
APU	0.04	0.31	6.30	0.52	0.05	0.04	1286.56	0.00	0.00
Total Proposed Action	15.24	56.95	157.41	8.96	0.61	0.52	26886.56	0.71	0.80

Table D3.3-27. Annual HAP Emissions for KC-46A Aircraft Operations at Pease - Proposed Action

Aircraft	Annual Emissions, Tons/year													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-46A LTOs	2.10	0.73	0.42	0.09	0.29	0.11	0.03	0.05	0.05	0.01	0.00	0.00	0.13	0.01
KC-46A Closed Pattern Ops	0.07	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.21	0.02
Total Proposed Action	2.17	0.75	0.43	0.10	0.30	0.11	0.03	0.05	0.05	0.01	0.01	0.00	0.34	0.02

Table D3.3-28. JP-8 AGE Equipment Emissions, Proposed Action, Pease

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/hr NOx	CO	VOC	PM10	PM2.5	SO2	Annual Emissions (lbs/yr) NOx	CO	VOC	PM10	PM2.5	SO2
KC-46A AGE																	
Sorties:	884																
	Hours/Sortie																
Generator A/M32A-86	10	8840.00	6.47	73856.77	148	6.10E+00	4.57E-01	2.94E-01	9.10E-02	8.90E-02	4.60E-02	1.19E+02	8.91E+00	5.73E+00	1.77E+00	1.73E+00	8.96E-01
Start Cart A/M32A-60A	1	884.00	10.16	8982.58	180	1.82E+00	5.48E+00	2.70E-01	2.11E-01	2.05E-01	7.18E-02	3.55E+00	1.07E+01	5.26E-01	4.11E-01	4.00E-01	1.40E-01
Start Cart A/M32A-95	0.1	88.40	8.75	773.50	155	1.47E+00	5.86E+00	7.00E-01	1.10E-01	1.07E-01	6.19E-02	2.86E-01	1.14E+00	1.36E-01	2.14E-02	2.09E-02	1.21E-02
Heater/AC Ace 802-993 AC	10	8840.00	6.80	135736.77	272	2.94E+00	1.50E-01	2.04E-01	1.98E-01	1.92E-01	4.80E-02	5.73E+01	2.92E+00	3.98E+00	3.86E+00	3.74E+00	9.35E-01
MA-3C Air Conditioner	2	1768.00	7.12	11976.77	120	4.17E+00	3.17E-01	5.30E-02	1.09E-01	1.05E-01	5.00E-02	1.62E+01	1.24E+00	2.07E-01	4.25E-01	4.09E-01	1.95E-01
H1	5	4420.00	0.39	1621.85	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.54E+00	1.76E+00	9.74E-01	1.06E+00	1.06E+00	2.92E-02
1H1	4	3536.00	0.39	1297.48	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.23E+00	1.41E+00	7.80E-01	8.50E-01	8.50E-01	2.34E-02
Light Cart NF-2	2	1768.00	1.02	1796.52	18	1.10E-01	8.00E-02	1.00E-02	1.00E-02	1.00E-02	7.18E-03	4.29E-01	3.12E-01	3.90E-02	3.90E-02	3.90E-02	2.80E-02
Air Compressor MC-1A	0.33	291.72	1.09	303.01	18.4	4.19E-01	2.67E-01	2.67E-01	7.10E-02	6.80E-02	8.00E-03	2.69E-01	1.72E-01	1.72E-01	4.57E-02	4.37E-02	5.15E-03
Total JP-8 AGE, Tons/year				hp-hrs	4186687.648							9.99E-02	1.43E-02	6.27E-03	4.24E-03	4.15E-03	1.13E-03

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.3-29. AGE HAP Emissions, Proposed Action, Pease

Pollutant	JP-8 Emission Factors Turbine (lb/1000 gal)	JP-8 Emission Factors Reciprocating (lb/1000 hp-hr)	JP-8 Actual Annual Emissions (lbs/yr)	Gasoline Emission Factor (lb/MMBTU)	Gasoline Annual Emissions (lbs/yr)
Arsenic	1.53E-03				
Acetaldehyde		5.40E-03	2.26E+01	7.00E-02	
Acrolein		6.48E-04	2.71E+00		
Benzene	7.65E-03	6.50E-03	2.72E+01		
Beryllium	4.31E-05				
1,3-Butadiene	2.22E-03	2.74E-04	1.15E+00		
Cadmium	6.67E-04				
Chromium	1.53E-03				
Formaldehyde	3.89E-02	8.30E-03	3.47E+01		
Lead	1.95E-03				
Manganese	1.10E-01				
Mercury	1.67E-04				
Maphthalene	4.87E-03	5.94E-04	2.49E+00		
Nickel	6.39E-04				
POM	5.56E-03	1.20E-03	5.02E+00		
Selenium	3.48E-03				
Toluene		2.90E-03	1.21E+01		
Xylenes		2.00E-03	8.37E+00		
Total			1.03E-02		

Table D3.3-30. JP-8 AGE Equipment GHG Emissions, Proposed Action, Pease

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/gal CO2	CH4	N2O	Annual Emissions (lbs/yr) CO2	CH4	N2O
KC-46A AGE											
Sorties:	884										
	Hours/Sortie										
Generator A/M32A-86	10	8840.00	6.47	73856.77	148	2.11E+01	5.91E-04	6.80E-04	1.56E+06	4.36E+01	5.02E+01
Start Cart A/M32A-60A	1	884.00	10.16	8982.58	180	2.11E+01	5.91E-04	6.80E-04	1.90E+05	5.31E+00	6.11E+00
Start Cart A/M32A-95	0.1	88.40	8.75	773.50	155	2.11E+01	5.91E-04	6.80E-04	1.63E+04	4.57E-01	5.26E-01
Heater/AC Ace 802-993 AC	10	8840.00	6.80	135736.77	272	2.11E+01	5.91E-04	6.80E-04	2.86E+06	8.02E+01	9.23E+01
MA-3C Air Conditioner	2	1768.00	7.12	11976.77	120	2.11E+01	5.91E-04	6.80E-04	2.53E+05	7.08E+00	8.14E+00
H1	5	4420.00	0.39	1621.85	6.5	2.11E+01	5.91E-04	6.80E-04	3.42E+04	9.59E-01	1.10E+00
1H1	4	3536.00	0.39	1297.48	6.5	2.11E+01	5.91E-04	6.80E-04	2.74E+04	7.67E-01	8.82E-01
Light Cart NF-2	2	1768.00	1.02	1796.52	18	2.11E+01	5.91E-04	6.80E-04	3.79E+04	1.06E+00	1.22E+00
Air Compressor MC-1A	0.33	291.72	1.09	303.01	18.4	2.11E+01	5.91E-04	6.80E-04	6.39E+03	1.79E-01	2.06E-01
Total JP-8 AGE, Metric Tons/year									2.26E+03	6.34E-02	7.29E-02

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.3-31. Aircraft Engine Emissions - Engine Tests, Proposed Action, Pease

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factors (lb/1000 lb fuel) VOC	CO	NOx	SO2	PM10	PM2.5	Emissions (lbs/yr) VOC	CO	NOx	SO2	PM10	PM2.5
KC-46A																	
Defueling	22	Idle	0.50	1	1,663	12.5	42.6	3.8	1.1	0.1	0.1	228.49	779.56	69.16	19.39	2.01	1.83
Maintenance Run	88	Idle	0.33	2	1,663	12.5	42.6	3.8	1.1	0.1	0.1	1,218.61	4,157.65	368.83	103.43	10.73	9.76
TRT Run 1 Engine	10	Idle	0.17	1	1,663	12.5	42.6	3.8	1.1	0.1	0.1	34.62	118.11	10.48	2.94	0.30	0.28
	10	80% RPM	0.08	1	16869.6	0.1	0.5	26.0	1.1	0.1	0.1	1.13	7.03	365.23	14.90	0.98	0.84
TRT Run 2 Engine	8	Idle	0.17	2	1,663	12.5	42.6	3.8	1.1	0.1	0.1	55.39	188.98	16.77	4.70	0.49	0.44
	8	80% RPM	0.08	2	16869.6	0.1	0.5	26.0	1.1	0.1	0.1	1.81	11.25	584.36	23.84	1.57	1.35
												0.77	2.63	0.71	0.08	0.01	0.01

Table D3.3-32. HAP Emissions, Engine Tests, Proposed Action, Pease

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factor (lb/1000 lb fuel) (1) Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-46A																			
Defueling	22	Idle	0.50	1	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
Maintenance Run	88	Idle	0.33	2	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
TRT Run 2 Engine	10	Idle	0.17	1	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
	10	80% RPM	0.08	1	16869.6	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
TRT Run 4 Engine	8	Idle	0.17	2	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
	8	80% RPM	0.08	2	16869.6	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03

Emissions, lbs/yr Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate	Total HAPs, TPY
11.32	6.49	1.43	4.46	1.70	0.46	0.75	0.82	0.06	0.02	0.02	1.23	0.09	0.09	
60.39	34.62	7.65	23.77	9.08	2.46	3.99	4.37	0.32	0.09	0.09	6.59	0.47	0.47	
1.72	0.98	0.22	0.68	0.26	0.07	0.11	0.12	0.01	0.00	0.00	0.19	0.01	0.01	
0.16	0.06	0.03	0.01	0.02	0.01	0.00	0.00	0.00	0.02	0.01	0.01	0.71	0.04	
2.74	1.57	0.35	1.08	0.41	0.11	0.18	0.20	0.01	0.00	0.00	0.30	0.02	0.02	
0.26	0.09	0.05	0.01	0.04	0.01	0.00	0.01	0.01	0.04	0.02	0.01	1.14	0.06	
0.03829426	0.02190906	0.00486654	0.01500001	0.00575329	0.00156476	0.00251865	0.00276341	0.00020897	8.83493E-05	7.40798E-05	0.004163144	0.0012232	0.00034488	0.09877262

Table D3.3-33. GHG Emissions, Engine Tests, Proposed Action, Pease

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factor(1) CO2 (lb/1000 lb fuel)	CH4 (lb/1000 lb fuel)	N2O (lb/1000 lb fuel)	Actual Emissions (lb/yr) CO2	CH4	N2O
KC-46A											
Defueling	22	Idle	0.50	1	1,663	3,216.0	0.1	0.1	58,837.36	1.63	1.83
Maintenance Run	88	Idle	0.33	2	1,663	3,216.0	0.1	0.1	313,799.27	8.68	9.76
TRT Run 2 Engine	10	Idle	0.17	1	1,663	3,216.0	0.1	0.1	8,914.75	0.25	0.28
	10	80% RPM	0.08	1	16869.6	3,216.0	0.1	0.1	45,210.53	1.25	1.41
TRT Run 4 Engine	8	Idle	0.17	2	1,663	3,216.0	0.1	0.1	14,263.60	0.39	0.44
	8	80% RPM	0.08	2	16869.6	3,216.0	0.1	0.1	72,336.84	2.00	2.25
Total, tpy									233	0.01	0.01

(1) CO2 emission factors obtained from AFCEC 2013.
CH4 and N2O emission factors were derived from Table A-101 for jet fuel in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005, using density of JP-8 as 6.8 lb/gallon.

Table D3.3-34. Pease Comparison of Emissions

	Annual Emissions, tons/year					
Baseline	VOC	CO	NOx	SO2	PM10	PM2.5
Aircraft Ops	2.41	36.29	73.94	6.29	0.33	0.33
AGE	0.00	0.01	0.07	0.00	0.00	0.00
Engine Tests	0.10	1.47	0.40	0.06	0.00	0.00
POVs	1.11	19.06	0.91	0.01	0.04	0.02
Total	3.62	56.84	75.32	6.36	0.37	0.35
Proposed Action	VOC	CO	NOx	SO2	PM10	PM2.5
Aircraft Ops	15.24	56.95	157.41	8.96	0.61	0.52
AGE	0.01	0.01	0.10	0.00	0.00	0.00
Engine Tests	0.77	2.63	0.71	0.08	0.01	0.01
POVs	0.91	17.45	0.70	0.01	0.04	0.02
Total	16.93	77.05	158.92	9.06	0.66	0.55
Net Increase	13.31	20.21	83.60	2.70	0.28	0.19

Table D3.3-35. Pease Comparison of HAP Emissions

	Annual HAP Emissions, tons/year													
Baseline	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
Aircraft Ops	0.13	0.00	0.00	0.00	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.21	0.02
AGE	0.01	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Engine Tests	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.14	0.01	0.00	0.00	0.02	0.02	0.00	0.01	0.00	0.01	0.00	0.00	0.21	0.02
Proposed Action	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
Aircraft Ops	2.17	0.75	0.43	0.10	0.30	0.11	0.03	0.05	0.05	0.01	0.01	0.00	0.34	0.02
AGE	0.02	0.01	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Engine Tests	0.04	0.02	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.22	0.79	0.44	0.11	0.32	0.12	0.03	0.05	0.05	0.01	0.01	0.01	0.34	0.02
Net Increase	2.08	0.78	0.44	0.11	0.30	0.09	0.03	0.04	0.05	0.01	0.00	0.01	0.12	0.01

Table D3.3-36. Pease Comparison of GHG Emissions

	Annual GHG Emissions, metric tons/year			
Baseline	CO2	CH4	N2O	CO2e
Aircraft Ops	17303	0.48	0.54	17480
AGE	1571	0.04	0.05	1588
Engine Tests	172	0.00	0.01	174
POVs	597	0.00	0.00	597
Total	19643	0.53	0.59	19839
Proposed Action	CO2	CH4	N2O	
Aircraft Ops	24391	0.64	0.72	24629
AGE	2262	0.06	0.07	2286
Engine Tests	233	0.01	0.01	235
POVs	612	0.00	0.00	612
Total	27499	0.71	0.80	27762
Net Increase	7855	0.18	0.21	7924

Pittsburgh ANGS

Table D3.4-1. Engine Emission Factors by Throttle Setting - KC-135 and KC-46A Aircraft

Engine Type/Throttle Setting	Fuel Flow (Pounds/Hour)	Emission Factors, lbs/1000 lbs fuel								
		VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
F-108-CF-100 (2)										
Idle	1013.76	2.1045	30.7	4	1.06	0.06	0.06	3216	8.90E-02	1.00E-01
Approach	2463.12	0.092	4.2	8.2	1.06	0.06	0.06	3216	8.90E-02	1.00E-01
Intermediate	6486.48	0.0575	0.09	16	1.06	0.05	0.05	3216	8.90E-02	1.00E-01
Military	7801.2	0.046	0.09	18.5	1.06	0.07	0.07	3216	8.90E-02	1.00E-01
P&W 4062 (3)										
Idle	1663.2	12.489	42.61	3.78	1.06	0.11	0.1	3216	8.90E-02	1.00E-01
Approach	5702.4	0.1035	1.93	12.17	1.06	0.05	0.04	3216	8.90E-02	1.00E-01
Climbout	16869.6	0.0805	0.5	25.98	1.06	0.07	0.06	3216	8.90E-02	1.00E-01
Take-Off	21621.6	0.092	0.61	34.36	1.06	0.08	0.07	3216	8.90E-02	1.00E-01
		Emissions, Pounds/Hour								
APU Use - P&W 4062		0.04	0.33	6.72	0.56	0.05	0.04	1373		

Notes: (1) Data are for one engine. The KC-135R has 4 engines and the KC-46A has 2 engines.
(2) Data from *Air Emissions Factor Guide to Air Force Mobile Sources* (AFCEC 2013).
(3) ICAO Engine Exhaust Emissions Data Bank - Subsonic Engines - (ICAO 2013).

Table D3.4-2. HAP Emission Factors - KC-135 and KC-46A Aircraft

Engine Type	Emission Factor (lb/1000 lb fuel) (1)													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
F108-CF-100														
Idle	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Approach	1.50E-02	0.00E+00	0.00E+00	0.00E+00	3.22E-03	6.23E-03	5.53E-04	1.61E-03	0.00E+00	1.85E-03	8.63E-04	7.63E-04	4.46E-02	3.81E-03
Intermediate	5.58E-03	0.00E+00	0.00E+00	0.00E+00	4.25E-04	1.42E-03	0.00E+00	5.42E-04	0.00E+00	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
Military	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03
P&W 4062 (3)														
Idle	1.78E+00	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Approach	1.48E-02	5.13E-03	2.94E-03	6.50E-04	2.02E-03	7.71E-04	2.09E-04	3.39E-04	3.71E-04	1.85E-03	8.63E-04	7.63E-04	4.46E-02	3.81E-03
Intermediate	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
Military	1.31E-02	4.56E-03	2.61E-03	5.78E-04	1.79E-03	6.85E-04	1.86E-04	3.01E-04	3.30E-04	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03

Notes: (1) Data are for one engine. The KC-135 has 4 engines and the KC-46A has 2 engines.
(2) Data from *Air Emissions Factor Guide to Air Force Mobile Sources* (AFCEC 2013), Table 2-9.

Table D3.4-3. Land and Take-off/Touch and Go Times in Mode and Fuel Usages - KC-135 and KC-46A Aircraft

	LTO			Touch & Go	
	Time in Mode (TIM)		Fuel Usage	TIM	Fuel Usage
Aircraft/Mode (Engine Throttle Setting)	Minutes	Hours	Pounds	Hours	Pounds
KC-135 (2)					
Taxi Out (Idle)	32.8	0.55	2217		
Take-off (Military)	0.7	0.01	364	0.01	364
Climbout (Intermediate)	2.5	0.04	1081	0.04	1081
Approach	5.2	0.09	854	0.09	854
Taxi In (Idle)	14.9	0.25	1007		
Totals	56.1	0.94	5523	0.14	2299
KC-46A (2)					
Taxi Out (Idle)	32.8	0.55	1818		
Take-off (Military)	0.7	0.01	505	0.01	505
Climbout (Intermediate)	2.5	0.04	1406	0.04	1406
Approach	5.2	0.09	988	0.09	988
Taxi In (Idle)	14.9	0.25	826		
Totals	56.1	0.94	5543	0.14	2899
APU Use, KC-46A (3)		Hours			
Pre-Flight - OBIGGS + Electric + Max ECS		1.50			
Pre-Flight - Main Engine Start + Electric		0.03			
Post-Flight - Electric + Min ECS		0.58			
Total Hours per LTO		2.12			

Notes: (1) Fuel usage per aircraft.

(2) TIM Data from Table 2-4, Transport Aircraft (AFCEC 2013).

(3) APU use from FTU/MOB1 Draft EIS.

Table D3.4-4. Land and Take-off/Touch and Go Total Fuel Usages and Emissions - KC-135 and KC-46A Aircraft

Aircraft/Mode	LTO			Emissions (Pounds)								
LTOs	Time in Mode (TIM)		Fuel Usage	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
	Minutes	Hours	Pounds									
KC-135 (2)												
Taxi Out (Idle)	32.8	0.55	2217	4.67	68.05	8.87	2.35	0.13	0.13	7129.08	0.20	0.22
Take-off (Military)	0.7	0.01	364	0.02	0.03	6.74	0.39	0.03	0.03	1170.80	0.03	0.04
Climbout (Intermediate)	2.5	0.04	1081	0.06	0.10	17.30	1.15	0.05	0.05	3476.75	0.10	0.11
Approach	5.2	0.09	854	0.08	3.59	7.00	0.91	0.05	0.05	2746.08	0.08	0.09
Taxi In (Idle)	14.9	0.25	1007	2.12	30.91	4.03	1.07	0.06	0.06	3238.52	0.09	0.10
Totals	56.1	0.935	5523	6.94	102.69	43.93	5.85	0.32	0.32	17761.24	0.49	0.55
KC-46A (2)												
Taxi Out (Idle)	32.8	0.55	1818	22.71	77.48	6.87	1.93	0.20	0.18	5848.08	0.16	0.18
Take-off (Military)	0.7	0.01	505	0.05	0.31	17.33	0.53	0.04	0.04	1622.48	0.04	0.05
Climbout (Intermediate)	2.5	0.04	1406	0.11	0.70	36.52	1.49	0.10	0.08	4521.05	0.13	0.14
Approach	5.2	0.09	988	0.10	1.91	12.03	1.05	0.05	0.04	3178.75	0.09	0.10
Taxi In (Idle)	14.9	0.25	826	10.32	35.20	3.12	0.88	0.09	0.08	2656.60	0.07	0.08
Totals	56.1	0.935	5543	33.29	115.60	75.88	5.88	0.48	0.42	17826.96	0.49	0.55

Aircraft/Mode	Touch and Go			Emissions (Pounds)								
Touch and Go	Time in Mode (TIM)		Fuel Usage	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
	Minutes	Hours	Pounds									
KC-135 (2)												
Take-off (Military)	0.70	0.01	364	0.02	0.03	6.74	0.39	0.03	0.03	1170.80	0.03	0.04
Climbout (Intermediate)	2.50	0.04	1081	0.06	0.10	17.30	1.15	0.05	0.05	3476.75	0.10	0.11
Approach	5.20	0.09	854	0.08	3.59	7.00	0.91	0.05	0.05	2746.08	0.08	0.09
Totals	8.40	0.14	2299	0.16	3.72	31.03	2.44	0.13	0.13	7393.64	0.20	0.23
KC-46A (2)												
Take-off (Military)	0.7	0.01	505	0.05	0.31	17.33	0.53	0.04	0.04	1622.48	0.04	0.05
Climbout (Intermediate)	2.5	0.04	1406	0.11	0.70	36.52	1.49	0.10	0.08	4521.05	0.13	0.14
Approach	5.2	0.09	988	0.10	1.91	12.03	1.05	0.05	0.04	3178.75	0.09	0.10
Totals	8.40	0.14	2899	0.26	2.92	65.89	3.07	0.19	0.16	9322.28	0.26	0.29

Table D3.4-5. Land and Take-off/Touch and Go Total Fuel Usages and HAP Emissions - KC-135 and KC-46A Aircraft

Aircraft/Mode	LTO			Emissions (Pounds)													
LTOs	Time in Mode (TIM)		Fuel Usage	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
	Minutes	Hours	Pounds														
KC-135 (2)																	
Taxi Out (Idle)	32.8	0.55	2217	0.21	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.15	0.01
Take-off (Military)	0.7	0.01	364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1081	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Approach	5.2	0.09	854	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Taxi In (Idle)	14.9	0.25	1007	0.10	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Totals	56.1	0.94	5523	0.33	0.00	0.00	0.01	0.01	0.04	0.00	0.01	0.00	0.01	0.00	0.00	0.31	0.02
KC-46A (2)																	
Taxi Out (Idle)	32.8	0.55	1818	3.24	1.13	0.65	0.14	0.44	0.17	0.05	0.07	0.08	0.01	0.00	0.00	0.12	0.01
Take-off (Military)	0.7	0.01	505	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1406	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Approach	5.2	0.09	988	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Taxi In (Idle)	14.9	0.25	826	1.47	0.51	0.29	0.06	0.20	0.08	0.02	0.03	0.04	0.00	0.00	0.00	0.06	0.00
Totals	56.1	0.94	5543	4.75	1.65	0.95	0.21	0.65	0.25	0.07	0.11	0.12	0.01	0.00	0.00	0.29	0.02

Aircraft/Mode	Touch and Go			Emissions (Pounds)													
Touch and Go	Time in Mode (TIM)		Fuel Usage	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
	Minutes	Hours	Pounds														
KC-135 (2)																	
Take-off (Military)	0.70	0.01	364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.50	0.04	1081	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Approach	5.20	0.09	854	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Totals	8.40	0.14	2299	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.01
KC-46A (2)																	
Take-off (Military)	0.7	0.01	505	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1406	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Approach	5.2	0.09	988	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Totals	8.40	0.14	2899	0.04	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.01

Table D3.4-6. Annual Air Operations for Aircraft at Pittsburgh - Baseline

	Number of Operations		
Aircraft	LTO	TGO	Total
KC-135	926	2545.5	6943

Table D3.4-7. KC-135 Aircraft Closed Pattern Operations at Pittsburgh, Baseline

Scenario/Operation	Operations/Year Fraction of Ops	Total Ops per Pattern	Engine Setting/Time in Mode per Operation (Minutes) 55%	58%	60%	70%	73%	85%
KC-135 VFR Profile	1	2546	1.08073231	1.05954148	3.23876605	0.6250811	0.10721551	0.60319134
KC-135 IFR Profile	0	0	5.90400061	2.76893508	3.98841687	0.45137435	0.10721551	0.60319134
Total Ops		2545.5						

Table D3.4-8. KC-135 Aircraft Closed Pattern Operations - Fuel Use and Emission Factors, Baseline

Factor			Engine Setting/Time in Mode per Operation (Minutes) 55%	58%	60%	70%	73%	85%
Fuel Use, lbs/hr			19910.88	20916.72	21922.56	25945.92	27589.32	31204.8
Emission Factors, lbs/1000 lbs fuel								
VOC			0.0704	0.0683	0.0661	0.0575	0.0539	0.0460
CO			1.6313	1.3744	1.1175	0.0900	0.0900	0.0900
NOx			13.0750	13.5625	14.0500	16.0000	16.7813	18.5000
SO2			1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
PM10			0.0538	0.0531	0.0525	0.0500	0.0563	0.0700
PM2.5			0.0538	0.0531	0.0525	0.0500	0.0563	0.0700
CO2			3216	3216	3216	3216	3216	3216
CH4			0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
N2O			0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

Table D3.4-9. KC-135 Aircraft Closed Pattern Operations - Emissions Per Operation, Baseline

Emissions per operation, lbs			VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-135 CA VFR Right Turns South Side			0.1614	2.4721	37.2809	2.6974	0.1393	0.1393	8183.7166	0.2265	0.2545
KC-135 CC IFR Right Turns Southwest Side			0.3286	6.2014	68.9372	5.2364	0.2676	0.2676	15886.9857	0.4397	0.4940
Emissions, closed pattern ops, tons/year			0.2054	3.1464	47.4492	3.4331	0.1773	0.1773	10415.8252	0.2882	0.3239

Table D3.4-10. Annual Air Emissions for KC-135 Aircraft Operations at Pittsburgh - Baseline

Aircraft	Annual Emissions, Tons/year								
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-135 LTOs	3.21	47.54	20.34	2.71	0.15	0.15	8223.46	0.23	0.26
KC-135 T&G	0.21	3.15	47.45	3.43	0.18	0.18	10415.83	0.29	0.32
Total Existing	3.42	50.69	67.79	6.14	0.33	0.33	18639.28	0.52	0.58

Table D3.4-11. Annual HAP Emissions for KC-135 Aircraft Operations at Pittsburgh - Baseline

Aircraft	Annual Emissions, Tons/year													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-135 LTOs	0.15	0.00	0.00	0.00	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.14	0.01
KC-135 Closed Pattern Ops	0.03	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.01
Total Existing	0.18	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.00	0.01	0.00	0.00	0.26	0.02

Table D3.4-12. JP-8 AGE Equipment Emissions, Pittsburgh, Baseline

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/hr						Annual Emissions (lbs/yr)					
						NOx	CO	VOC	PM10	PM2.5	SO2	NOx	CO	VOC	PM10	PM2.5	SO2
KC-135 AGE																	
Sorties:	926																
	Hours/Sortie																
Generator A/M32A-86	10	9260.00	6.47	77365.81	148	6.10E+00	4.57E-01	2.94E-01	9.10E-02	8.90E-02	4.60E-02	1.25E+02	9.33E+00	6.00E+00	1.86E+00	1.82E+00	9.39E-01
Start Cart A/M32A-60A	1	926.00	10.16	9409.35	180	1.82E+00	5.48E+00	2.70E-01	2.11E-01	2.05E-01	7.18E-02	3.72E+00	1.12E+01	5.51E-01	4.31E-01	4.19E-01	1.47E-01
Start Cart A/M32A-95	0.1	92.60	8.75	810.25	155	1.47E+00	5.86E+00	7.00E-01	1.10E-01	1.07E-01	6.19E-02	3.00E-01	1.20E+00	1.43E-01	2.25E-02	2.18E-02	1.26E-02
Heater/AC Ace 802-993 AC	10	9260.00	6.80	142185.81	272	2.94E+00	1.50E-01	2.04E-01	1.98E-01	1.92E-01	4.80E-02	6.00E+01	3.06E+00	4.16E+00	4.04E+00	3.92E+00	9.80E-01
MA-3C Air Conditioner	2	1852.00	7.12	12545.81	120	4.17E+00	3.17E-01	5.30E-02	1.09E-01	1.05E-01	5.00E-02	1.70E+01	1.29E+00	2.16E-01	4.45E-01	4.29E-01	2.04E-01
H1	5	4630.00	0.39	1698.91	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.61E+00	1.85E+00	1.02E+00	1.11E+00	1.11E+00	3.06E-02
1H1	4	3704.00	0.39	1359.13	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.29E+00	1.48E+00	8.17E-01	8.90E-01	8.90E-01	2.45E-02
Light Cart NF-2	2	1852.00	1.02	1881.87	18	1.10E-01	8.00E-02	1.00E-02	1.00E-02	1.00E-02	7.18E-03	4.49E-01	3.27E-01	4.08E-02	4.08E-02	4.08E-02	2.93E-02
Air Compressor MC-1A	0.33	305.58	1.09	317.41	18.4	4.19E-01	2.67E-01	2.67E-01	7.10E-02	6.80E-02	8.00E-03	2.82E-01	1.80E-01	1.80E-01	4.78E-02	4.58E-02	5.39E-03
Total JP-8 AGE, Tons/year				hp-hrs	4385602.672							1.05E-01	1.50E-02	6.57E-03	4.44E-03	4.35E-03	1.19E-03

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.4-13. AGE HAP Emissions, Pittsburgh, Baseline

Pollutant	JP-8			Gasoline	
	Emission Factors		Actual Annual Emissions (lbs/yr)	Emission Factor (lb/MMBTU)	Annual Emissions (lbs/yr)
	Turbine (lb/1000 gal)	Reciprocating (lb/1000 hp-hr)			
Arsenic	1.53E-03				
Acetaldehyde		5.40E-03	2.37E+01	7.00E-02	
Acrolein		6.48E-04	2.84E+00		
Benzene	7.65E-03	6.50E-03	2.85E+01		
Beryllium	4.31E-05				
1,3-Butadiene	2.22E-03	2.74E-04	1.20E+00		
Cadmium	6.67E-04				
Chromium	1.53E-03				
Formaldehyde	3.89E-02	8.30E-03	3.64E+01		
Lead	1.95E-03				
Manganese	1.10E-01				
Mercury	1.67E-04				
Maphthalene	4.87E-03	5.94E-04	2.61E+00		
Nickel	6.39E-04				
POM	5.56E-03	1.20E-03	5.26E+00		
Selenium	3.48E-03				
Toluene		2.90E-03	1.27E+01		
Xylenes		2.00E-03	8.77E+00		
Total			1.07E-02		

Table D3.4-14. JP-8 AGE Equipment GHG Emissions, Pittsburgh, Baseline

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/gal			Annual Emissions (lbs/yr)		
						CO2	CH4	N2O	CO2	CH4	N2O
KC-135 AGE											
Sorties:	926										
	Hours/Sortie										
Generator A/M32A-86	10	9260.00	6.47	77365.81	148	2.11E+01	5.91E-04	6.80E-04	1.63E+06	4.57E+01	5.26E+01
Start Cart A/M32A-60A	1	926.00	10.16	9409.35	180	2.11E+01	5.91E-04	6.80E-04	1.99E+05	5.56E+00	6.40E+00
Start Cart A/M32A-95	0.1	92.60	8.75	810.25	155	2.11E+01	5.91E-04	6.80E-04	1.71E+04	4.79E-01	5.51E-01
Heater/AC Ace 802-993 AC	10	9260.00	6.80	142185.81	272	2.11E+01	5.91E-04	6.80E-04	3.00E+06	8.40E+01	9.67E+01
MA-3C Air Conditioner	2	1852.00	7.12	12545.81	120	2.11E+01	5.91E-04	6.80E-04	2.65E+05	7.41E+00	8.53E+00
H1	5	4630.00	0.39	1698.91	6.5	2.11E+01	5.91E-04	6.80E-04	3.58E+04	1.00E+00	1.16E+00
1H1	4	3704.00	0.39	1359.13	6.5	2.11E+01	5.91E-04	6.80E-04	2.87E+04	8.03E-01	9.24E-01
Light Cart NF-2	2	1852.00	1.02	1881.87	18	2.11E+01	5.91E-04	6.80E-04	3.97E+04	1.11E+00	1.28E+00
Air Compressor MC-1A	0.33	305.58	1.09	317.41	18.4	2.11E+01	5.91E-04	6.80E-04	6.70E+03	1.88E-01	2.16E-01
Total JP-8 AGE, Metric Tons/year									2.37E+03	6.64E-02	7.64E-02

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.4-15. Aircraft Engine Emissions - Engine Tests, Pittsburgh, Baseline

						Emission Factors (lb/1000 lb fuel)						Emissions (lbs/yr)					
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	VOC	CO	NOx	SO2	PM10	PM2.5	VOC	CO	NOx	SO2	PM10	PM2.5
KC-135																	
Defueling	17	Idle	0.50	1	1,014	2.1	30.7	4.0	1.1	0.1	0.1	18.13	264.54	34.47	9.13	1.05	1.05
Maintenance Run	69	Idle	0.33	4	1,014	2.1	30.7	4.0	1.1	0.1	0.1	196.28	2,863.26	373.06	98.86	11.36	11.36
TRT Run 2 Engine	8	Idle	0.17	2	1,014	2.1	30.7	4.0	1.1	0.1	0.1	5.69	82.99	10.81	2.87	0.33	0.33
	8	80% RPM	0.08	2	7801.2	0.0	0.1	18.5	1.1	0.1	0.1	0.48	0.94	192.43	11.03	1.14	1.14
TRT Run 4 Engine	6	Idle	0.17	4	1,014	2.1	30.7	4.0	1.1	0.1	0.1	8.53	124.49	16.22	4.30	0.49	0.49
	6	80% RPM	0.08	4	7801.2	0.0	0.1	18.5	1.1	0.1	0.1	0.72	1.40	288.64	16.54	1.71	1.71
												0.11	1.67	0.46	0.07	0.01	0.01

Table D3.4-16. HAP Emissions, Engine Tests, Pittsburgh, Baseline

						Emission Factor (lb/1000 lb fuel) (1)													
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-135																			
Defueling	17	Idle	0.50	1	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Maintenance Run	69	Idle	0.33	4	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
TRT Run 2 Engine	8	Idle	0.17	2	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
	8	80% RPM	0.08	2	7801.2	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03
TRT Run 4 Engine	6	Idle	0.17	4	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
	6	80% RPM	0.08	4	7801.2	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03

Emissions, lbs/yr														
Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate	Total HAPs, TPY
0.82	0.00	0.00	0.02	0.02	0.08	0.01	0.01	0.01	0.02	0.01	0.01	0.58	0.04	
8.87	0.00	0.00	0.27	0.18	0.84	0.06	0.15	0.14	0.22	0.09	0.09	6.30	0.45	
0.26	0.00	0.00	0.01	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.18	0.01	
0.07	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.01	0.02	0.03	
0.39	0.00	0.00	0.01	0.01	0.04	0.00	0.01	0.01	0.01	0.00	0.00	0.27	0.02	
0.11	0.00	0.00	0.00	0.02	0.02	0.00	0.01	0.00	0.02	0.01	0.01	0.03	0.04	
0.00525704	0	0	0.00015753	0.00011764	0.00050169	3.7155E-05	9.3998E-05	8.0395E-05	0.000140823	5.39764E-05	5.88753E-05	0.00369213	0.00029492	0.01048617

Table D3.4-17. GHG Emissions, Engine Tests, Pittsburgh, Baseline

						Emission Factor(1)					
						CO2	CH4	N2O	Actual Emissions (lb/yr)		
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	(lb/1000 lb fuel)	(lb/1000 lb fuel)	(lb/1000 lb fuel)	CO2	CH4	N2O
KC-135											
Defueling	17	Idle	0.50	1	1,014	3,216.0	0.1	0.1	27,712.14	0.77	0.86
Maintenance Run	69	Idle	0.33	4	1,014	3,216.0	0.1	0.1	299,943.20	8.30	9.33
TRT Run 2 Engine	8	Idle	0.17	2	1,014	3,216.0	0.1	0.1	8,694.01	0.24	0.27
	8	80% RPM	0.08	2	7801.2	3,216.0	0.1	0.1	33,451.55	0.93	1.04
TRT Run 4 Engine	6	Idle	0.17	4	1,014	3,216.0	0.1	0.1	13,041.01	0.36	0.41
	6	80% RPM	0.08	4	7801.2	3,216.0	0.1	0.1	50,177.32	1.39	1.56
Total, tpy									196	0.01	0.01

(1) CO2 emission factors obtained from AFCEC 2013.
CH4 and N2O emission factors were derived from Table A-101 for jet fuel in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005,
using density of JP-8 as 6.8 lb/gallon.

Table D3.4-18. Annual Worker Population and VMT at Pittsburgh - KC-46A Project Scenarios

Scenario	Total # of Workers	Annual On-Base VMT	Annual Off-Base VMT
Existing	1014	263640	4734974.4
Proposed Action	1037	269620	4842375.2

[1]On-Base mileage based on 1.00 miles from 2009 AEI; assume 260 days/year

[2]Off-Base mileage based on distance to downtown Pittsburgh, 17.96 miles; assume 260 days/year

Table D3.4-19. Annual Average On-Road Vehicle Emission Factors - Pittsburgh

		Emission Factors (Grams/Mile)						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	0.586	10.45	0.446	0.007	0.025	0.011	368.1
LDDT	0.03	0.132	0.808	0.2	0.003	0.053	0.037	314
LDGT	60.32	0.831	12.34	0.707	0.01	0.025	0.011	516.1
LDDT	0.2	0.393	0.708	0.46	0.006	0.06	0.044	599.2
HDGV	0	1.066	28.64	1.21	0.017	0.049	0.032	905.3
HDDV	0	0.684	2.315	3.359	0.012	0.129	0.1	1245.6
MC	1.9	2.75	27.81	0.87	0.003	0.037	0.021	177.4
Proposed Action (Year 2018) (1)								
LDGV	37.55	0.446	9.55	0.318	0.007	0.025	0.011	368
LDDT	0.03	0.087	0.692	0.088	0.003	0.038	0.023	314.1
LDGT	60.32	0.668	10.77	0.53	0.01	0.025	0.011	516.6
LDDT	0.2	0.305	0.6	0.317	0.006	0.047	0.032	598.6
HDGV	0	0.773	26.93	0.682	0.017	0.04	0.025	904
HDDV	0	0.583	1.428	1.919	0.012	0.078	0.053	1245.9
MC	1.9	2.75	27.81	0.87	0.003	0.037	0.021	177.4

Notes: (1) Emission factors from AFCEC 2013, Table 5-13, for 2017 used to provide a conservative estimate of emissions for 2018

Table D3.4-20. Annual Average On-Base Vehicle Emissions, Pittsburgh

		Emissions, lbs/year						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	127.90	2280.73	97.34	1.53	5.46	2.40	80338.48
LDDT	0.03	0.02	0.14	0.03	0.00	0.01	0.01	54.75
LDGT	60.32	291.35	4326.38	247.87	3.51	8.76	3.86	180943.52
LDDT	0.2	0.46	0.82	0.53	0.01	0.07	0.05	696.55
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	30.37	307.12	9.61	0.03	0.41	0.23	1959.09
Total Existing, tons/year		0.23	3.46	0.18	0.00	0.01	0.00	132.00
Proposed Action (Year 2018) (1)								
LDGV	37.55	99.55	2131.58	70.98	1.56	5.58	2.46	82138.43
LDDT	0.03	0.02	0.12	0.02	0.00	0.01	0.00	56.01
LDGT	60.32	239.51	3861.59	190.03	3.59	8.96	3.94	185227.03
LDDT	0.2	0.36	0.71	0.38	0.01	0.06	0.04	711.63
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	31.06	314.08	9.83	0.03	0.42	0.24	2003.53
Total Proposed Action, tons/year		0.19	3.15	0.14	0.00	0.01	0.00	135.07

Table D3.4-21. Annual Average Off-Base Vehicle Emissions, Pittsburgh

		Emissions, lbs/year						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	2297.00	40961.93	1748.23	27.44	98.00	43.12	1442879.03
LDDT	0.03	0.41	2.53	0.63	0.01	0.17	0.12	983.34
LDGT	60.32	5232.59	77701.72	4451.79	62.97	157.42	69.26	3249745.54
LDDT	0.2	8.20	14.78	9.60	0.13	1.25	0.92	12509.96
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	545.43	5515.80	172.55	0.60	7.34	4.17	35185.31
Total Existing, tons/year		4.04	62.10	3.19	0.05	0.13	0.06	2370.65
Proposed Action (Year 2018) (1)								
LDGV	37.55	1748.23	37434.11	1246.50	27.44	98.00	43.12	1442487.05
LDDT	0.03	0.27	2.17	0.28	0.01	0.12	0.07	983.66
LDGT	60.32	4206.22	67815.85	3337.27	62.97	157.42	69.26	3252893.90
LDDT	0.2	6.37	12.53	6.62	0.13	0.98	0.67	12497.43
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	545.43	5515.80	172.55	0.60	7.34	4.17	35185.31
Total Proposed Action, tons/year		3.25	55.39	2.38	0.05	0.13	0.06	2372.02

Table D3.4-22. Annual Air Operations for Aircraft at Pittsburgh - Proposed Action

	Number of Operations		
Aircraft	LTO	TGO	Total
KC-46A	1186	3427	9226

Table D3.4-23. KC-46A Aircraft Closed Pattern Operations at Pittsburgh - KC-46A Proposed Scenarios

Scenario/Operation	Operations/Year: Fraction of Ops	Operations/Year: Total Ops per Pattern	Engine Setting/Time in Mode per Operation (Minutes): 55%	58%	60%	68%	73%	83%	85%
KC-46A VFR Profile	1	3427	1.52770185	1.04541426	2.57545944	0.66856113	0.06861792	0.3602441	0.39626852
KC-46A IFR Profile	0	0	5.24755579	1.580018	4.11836013	1.16386557	0.06861792	0.39455307	0.33222512
Total Ops		3427							

Table D3.4-24. KC-46A Aircraft Closed Pattern Operations - Fuel Use and Emission Factors

Factor			Engine Setting/Time in Mode per Operation (Minutes): 55%	58%	60%	68%	73%	83%	85%
Fuel Use, lbs/hr			22572	23688.8	24805.6	28379.36	30389.6	34928	36116
Emission Factors, lbs/1000 lbs									
VOC			0.0920	0.0909	0.0897	0.0860	0.0840	0.0819	0.0834
CO			1.2150	1.1435	1.0720	0.8432	0.7145	0.5138	0.5275
NOx			19.0750	19.7655	20.4560	22.6656	23.9085	27.0275	28.0750
SO2			1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
PM10			0.0600	0.0610	0.0620	0.0652	0.0670	0.0713	0.0725
PM2.5			0.0500	0.0510	0.0520	0.0552	0.0570	0.0613	0.0625
CO2			3216	3216	3216	3216	3216	3216	3216
CH4			0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
N2O			0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

Table D3.4-25. KC-46A Aircraft Closed Pattern Operations - Emissions Per Operation

Emissions per operation, lbs			VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-46A CA VFR Right Turns South Side			0.2531	2.8367	61.2646	3.0225	0.1809	0.1523	9170.2396	0.2538	0.2851
KC-46A CC IFR Right Turns Southwest Side			0.4768	5.6496	109.9461	5.6344	0.3311	0.2780	17094.6253	0.4731	0.5315
Emissions, closed pattern ops, tons/year			0.4336	4.8607	104.9769	5.1791	0.3099	0.2610	15713.2056	0.4348	0.4886

Table D3.4-26. Annual Air Emissions for KC-46A Aircraft Operations at Pittsburgh - Proposed Action

Aircraft	Annual Emissions, Tons/year								
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-46A LTOs	19.74	68.55	45.00	3.48	0.28	0.25	10571.39	0.29	0.33
KC-46A T&G	0.43	4.86	104.98	5.18	0.31	0.26	15713.21	0.43	0.49
APU	0.05	0.41	8.45	0.70	0.06	0.05	1726.08	0.00	0.00
Total Proposed Action	20.22	73.83	158.42	9.37	0.66	0.56	28010.67	0.73	0.82

Table D3.4-27. Annual HAP Emissions for KC-135 Aircraft Operations at Pittsburgh - Proposed Action

Aircraft	Annual Emissions, Tons/year													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-46 LTOs	2.82	0.98	0.56	0.12	0.39	0.15	0.04	0.06	0.07	0.01	0.00	0.00	0.17	0.01
KC-46 Closed Pattern Ops	0.06	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.20	0.01
Total Proposed Action	2.88	1.00	0.57	0.13	0.39	0.15	0.04	0.07	0.07	0.02	0.01	0.01	0.37	0.03

Table D3.4-28. JP-8 AGE Equipment Emissions, Pittsburgh, Proposed Action

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/hr						Annual Emissions (lbs/yr)					
						NOx	CO	VOC	PM10	PM2.5	SO2	NOx	CO	VOC	PM10	PM2.5	SO2
KC-46A AGE																	
Sorties:	1186																
	Hours/Sortie																
Generator A/M32A-86	10	11860.00	6.47	99088.39	148	6.10E+00	4.57E-01	2.94E-01	9.10E-02	8.90E-02	4.60E-02	1.60E+02	1.19E+01	7.69E+00	2.38E+00	2.33E+00	1.20E+00
Start Cart A/M32A-60A	1	1186.00	10.16	12051.29	180	1.82E+00	5.48E+00	2.70E-01	2.11E-01	2.05E-01	7.18E-02	4.76E+00	1.43E+01	7.06E-01	5.52E-01	5.36E-01	1.88E-01
Start Cart A/M32A-95	0.1	118.60	8.75	1037.75	155	1.47E+00	5.86E+00	7.00E-01	1.10E-01	1.07E-01	6.19E-02	3.84E-01	1.53E+00	1.83E-01	2.88E-02	2.80E-02	1.62E-02
Heater/AC Ace 802-993 AC	10	11860.00	6.80	182108.39	272	2.94E+00	1.50E-01	2.04E-01	1.98E-01	1.92E-01	4.80E-02	7.68E+01	3.92E+00	5.33E+00	5.18E+00	5.02E+00	1.26E+00
MA-3C Air Conditioner	2	2372.00	7.12	16068.39	120	4.17E+00	3.17E-01	5.30E-02	1.09E-01	1.05E-01	5.00E-02	2.18E+01	1.66E+00	2.77E-01	5.70E-01	5.49E-01	2.61E-01
H1	5	5930.00	0.39	2175.93	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	2.07E+00	2.37E+00	1.31E+00	1.43E+00	1.43E+00	3.92E-02
1H1	4	4744.00	0.39	1740.74	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.65E+00	1.89E+00	1.05E+00	1.14E+00	1.14E+00	3.14E-02
Light Cart NF-2	2	2372.00	1.02	2410.26	18	1.10E-01	8.00E-02	1.00E-02	1.00E-02	1.00E-02	7.18E-03	5.75E-01	4.18E-01	5.23E-02	5.23E-02	5.23E-02	3.76E-02
Air Compressor MC-1A	0.33	391.38	1.09	406.53	18.4	4.19E-01	2.67E-01	2.67E-01	7.10E-02	6.80E-02	8.00E-03	3.62E-01	2.30E-01	2.30E-01	6.13E-02	5.87E-02	6.90E-03
Total JP-8 AGE, Tons/year				hp-hrs	5616981.392							1.34E-01	1.91E-02	8.41E-03	5.69E-03	5.57E-03	1.52E-03

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.4-29. AGE HAP Emissions, Pittsburgh, Proposed Action

Pollutant	JP-8			Gasoline	
	Emission Factors		Actual Annual Emissions (lbs/yr)	Emission Factor (lb/MMBTU)	Annual Emissions (lbs/yr)
	Turbine (lb/1000 gal)	Reciprocating (lb/1000 hp-hr)			
Arsenic	1.53E-03				
Acetaldehyde		5.40E-03	3.03E+01	7.00E-02	
Acrolein		6.48E-04	3.64E+00		
Benzene	7.65E-03	6.50E-03	3.65E+01		
Beryllium	4.31E-05				
1,3-Butadiene	2.22E-03	2.74E-04	1.54E+00		
Cadmium	6.67E-04				
Chromium	1.53E-03				
Formaldehyde	3.89E-02	8.30E-03	4.66E+01		
Lead	1.95E-03				
Manganese	1.10E-01				
Mercury	1.67E-04				
Maphthalene	4.87E-03	5.94E-04	3.34E+00		
Nickel	6.39E-04				
POM	5.56E-03	1.20E-03	6.74E+00		
Selenium	3.48E-03				
Toluene		2.90E-03	1.63E+01		
Xylenes		2.00E-03	1.12E+01		
Total			1.38E-02		

Table D3.4-30. JP-8 AGE Equipment GHG Emissions, Pittsburgh, Proposed Action

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/gal			Annual Emissions (lbs/yr)		
						CO2	CH4	N2O	CO2	CH4	N2O
KC-46 AGE											
Sorties:	1186										
	Hours/Sortie										
Generator A/M32A-86	10	11860.00	6.47	99088.39	148	2.11E+01	5.91E-04	6.80E-04	2.09E+06	5.86E+01	6.74E+01
Start Cart A/M32A-60A	1	1186.00	10.16	12051.29	180	2.11E+01	5.91E-04	6.80E-04	2.54E+05	7.12E+00	8.19E+00
Start Cart A/M32A-95	0.1	118.60	8.75	1037.75	155	2.11E+01	5.91E-04	6.80E-04	2.19E+04	6.13E-01	7.06E-01
Heater/AC Ace 802-993 AC	10	11860.00	6.80	182108.39	272	2.11E+01	5.91E-04	6.80E-04	3.84E+06	1.08E+02	1.24E+02
MA-3C Air Conditioner	2	2372.00	7.12	16068.39	120	2.11E+01	5.91E-04	6.80E-04	3.39E+05	9.50E+00	1.09E+01
H1	5	5930.00	0.39	2175.93	6.5	2.11E+01	5.91E-04	6.80E-04	4.59E+04	1.29E+00	1.48E+00
1H1	4	4744.00	0.39	1740.74	6.5	2.11E+01	5.91E-04	6.80E-04	3.67E+04	1.03E+00	1.18E+00
Light Cart NF-2	2	2372.00	1.02	2410.26	18	2.11E+01	5.91E-04	6.80E-04	5.09E+04	1.42E+00	1.64E+00
Air Compressor MC-1A	0.33	391.38	1.09	406.53	18.4	2.11E+01	5.91E-04	6.80E-04	8.58E+03	2.40E-01	2.76E-01
Total JP-8 AGE, Metric Tons/year									3.03E+03	8.50E-02	9.78E-02

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.4-31. Aircraft Engine Emissions - Engine Tests, Pittsburgh, Proposed Action

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factors (lb/1000 lb fuel) VOC	CO	NOx	SO2	PM10	PM2.5	Emissions (lbs/yr) VOC	CO	NOx	SO2	PM10	PM2.5
KC-46A																	
Defueling	23	Idle	0.50	1	1,663	12.5	42.6	3.8	1.1	0.1	0.1	238.87	814.99	72.30	20.27	2.10	1.91
Maintenance Run	92	Idle	0.33	2	1,663	12.5	42.6	3.8	1.1	0.1	0.1	1,274.00	4,346.63	385.60	108.13	11.22	10.20
TRT Run 1 Engine	11	Idle	0.17	1	1,663	12.5	42.6	3.8	1.1	0.1	0.1	38.08	129.93	11.53	3.23	0.34	0.30
	11	80% RPM	0.08	1	16869.6	0.1	0.5	26.0	1.1	0.1	0.1	1.24	7.73	401.75	16.39	1.08	0.93
TRT Run 2 Engine	8	Idle	0.17	2	1,663	12.5	42.6	3.8	1.1	0.1	0.1	55.39	188.98	16.77	4.70	0.49	0.44
	8	80% RPM	0.08	2	16869.6	0.1	0.5	26.0	1.1	0.1	0.1	1.81	11.25	584.36	23.84	1.57	1.35
												0.80	2.75	0.74	0.09	0.01	0.01

Table D3.4-32. HAP Emissions, Engine Tests, Pittsburgh, Proposed Action

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factor (lb/1000 lb fuel) (1) Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-46A																			
Defueling	23	Idle	0.50	1	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
Maintenance Run	92	Idle	0.33	2	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
TRT Run 2 Engine	11	Idle	0.17	1	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
	11	80% RPM	0.08	1	16869.6	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
TRT Run 4 Engine	8	Idle	0.17	2	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
	8	80% RPM	0.08	2	16869.6	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03

Emissions, lbs/yr Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate	Total HAPs, TPY
11.84	6.79	1.50	4.66	1.78	0.48	0.78	0.86	0.06	0.02	0.02	1.29	0.09	0.09	
63.13	36.20	8.00	24.85	9.49	2.58	4.17	4.57	0.34	0.09	0.10	6.89	0.49	0.49	
1.89	1.08	0.24	0.74	0.28	0.08	0.12	0.14	0.01	0.00	0.00	0.21	0.01	0.01	
0.18	0.06	0.04	0.01	0.02	0.01	0.00	0.00	0.00	0.03	0.01	0.01	0.78	0.04	
2.74	1.57	0.35	1.08	0.41	0.11	0.18	0.20	0.01	0.00	0.00	0.30	0.02	0.02	
0.26	0.09	0.05	0.01	0.04	0.01	0.00	0.01	0.01	0.04	0.02	0.01	1.14	0.06	
0.04001785	0.02289548	0.00508548	0.015675625	0.00601226	0.00163517	0.00263209	0.00288785	0.00021835	9.21172E-05	7.73212E-05	0.004350612	0.00127221	0.00036011	0.10321253

Table D3.4-33. GHG Emissions, Engine Tests, Pittsburgh, Proposed Action

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factor(1) CO2 (lb/1000 lb fuel)	CH4 (lb/1000 lb fuel)	N2O (lb/1000 lb fuel)	Actual Emissions (lb/yr) CO2	CH4	N2O
KC-46A											
Defueling	23	Idle	0.50	1	1,663	3,216.0	0.1	0.1	61,511.79	1.70	1.91
Maintenance Run	92	Idle	0.33	2	1,663	3,216.0	0.1	0.1	328,062.87	9.08	10.20
TRT Run 2 Engine	11	Idle	0.17	1	1,663	3,216.0	0.1	0.1	9,806.23	0.27	0.30
	11	80% RPM	0.08	1	16869.6	3,216.0	0.1	0.1	49,731.58	1.38	1.55
TRT Run 4 Engine	8	Idle	0.17	2	1,663	3,216.0	0.1	0.1	14,263.60	0.39	0.44
	8	80% RPM	0.08	2	16869.6	3,216.0	0.1	0.1	72,336.84	2.00	2.25
Total, tpy									243	0.01	0.01

(1) CO2 emission factors obtained from AFCEC 2013.
CH4 and N2O emission factors were derived from Table A-101 for jet fuel in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005, using density of JP-8 as 6.8 lb/gallon.

Table D3.4-34. Pittsburgh Comparison of Emissions

	Annual Emissions, tons/year					
Baseline	VOC	CO	NOx	SO2	PM10	PM2.5
Aircraft Ops	3.42	50.69	67.79	6.14	0.33	0.33
AGE	0.01	0.01	0.10	0.00	0.00	0.00
Engine Tests	0.11	1.67	0.46	0.07	0.01	0.01
POVs	4.27	65.56	3.37	0.05	0.14	0.06
Total	7.81	117.93	71.72	6.26	0.48	0.40
Proposed Action	VOC	CO	NOx	SO2	PM10	PM2.5
Aircraft Ops	20.22	73.83	158.42	9.37	0.66	0.56
AGE	0.01	0.02	0.13	0.00	0.01	0.01
Engine Tests	0.80	2.75	0.74	0.09	0.01	0.01
POVs	3.44	58.54	2.52	0.05	0.14	0.06
Total	24.48	135.14	161.81	9.51	0.81	0.64
Net Increase	16.67	17.21	90.09	3.24	0.33	0.24

Table D3.4-35. Pittsburgh Comparison of HAP Emissions

	Annual HAP Emissions, tons/year													
Baseline	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
Aircraft Ops	0.18	0.00	0.00	0.00	0.01	0.03	0.00	0.01	0.00	0.01	0.00	0.00	0.26	0.02
AGE	0.02	0.01	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Engine Tests	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.20	0.01	0.00	0.01	0.02	0.03	0.00	0.01	0.00	0.01	0.00	0.00	0.27	0.02
Proposed Action	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
Aircraft Ops	2.88	1.00	0.57	0.13	0.39	0.15	0.04	0.07	0.07	0.02	0.01	0.01	0.37	0.03
AGE	0.02	0.02	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Engine Tests	0.04	0.02	0.01	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	2.95	1.04	0.58	0.14	0.42	0.16	0.04	0.07	0.07	0.02	0.01	0.01	0.38	0.03
Net Increase	2.74	1.03	0.58	0.14	0.39	0.12	0.04	0.06	0.07	0.01	0.00	0.01	0.11	0.01

Table D3.4-36. Pittsburgh Comparison of GHG Emissions

	Annual GHG Emissions, metric tons/year			
Baseline	CO2	CH4	N2O	CO2e
Aircraft Ops	16909	0.47	0.53	17082
AGE	2370	0.07	0.08	2395
Engine Tests	196	0.01	0.01	198
POVs	2270	0.00	0.00	2270
Total	21746	0.54	0.61	21946
Proposed Action	CO2	CH4	N2O	
Aircraft Ops	25411	0.66	0.74	25655
AGE	3035	0.09	0.10	3067
Engine Tests	243	0.01	0.01	245
POVs	2274	0.00	0.00	2274
Total	30963	0.75	0.85	31242
Net Increase	9218	0.21	0.24	9296

Table D3.5-1. Engine Emission Factors by Throttle Setting - KC-135 and KC-46A Aircraft

Engine Type/Throttle Setting	Fuel Flow (Pounds/Hour)	Emission Factors, lbs/1000 lbs fuel VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
F-108-CF-100 (2)										
Idle	1013.76	2.1045	30.7	4	1.06	0.06	0.06	3216	8.90E-02	1.00E-01
Approach	2463.12	0.092	4.2	8.2	1.06	0.06	0.06	3216	8.90E-02	1.00E-01
Intermediate	6486.48	0.0575	0.09	16	1.06	0.05	0.05	3216	8.90E-02	1.00E-01
Military	7801.2	0.046	0.09	18.5	1.06	0.07	0.07	3216	8.90E-02	1.00E-01
P&W 4062 (3)										
Idle	1663.2	12.489	42.61	3.78	1.06	0.11	0.1	3216	8.90E-02	1.00E-01
Approach	5702.4	0.1035	1.93	12.17	1.06	0.05	0.04	3216	8.90E-02	1.00E-01
Climbout	16869.6	0.0805	0.5	25.98	1.06	0.07	0.06	3216	8.90E-02	1.00E-01
Take-Off	21621.6	0.092	0.61	34.36	1.06	0.08	0.07	3216	8.90E-02	1.00E-01
		Emissions, Pounds/Hour								
APU Use - P&W 4062		0.04	0.33	6.72	0.56	0.05	0.04	1373		

Notes: (1) Data are for one engine. The KC-135R has 4 engines and the KC-46A has 2 engines.
(2) Data from *Air Emissions Factor Guide to Air Force Mobile Sources* (AFCEC 2013).
(3) ICAO Engine Exhaust Emissions Data Bank - Subsonic Engines - (ICAO 2013).

Table D3.5-2. HAP Emission Factors - KC-135 and KC-46A Aircraft

Engine Type	Emission Factor (lb/1000 lb fuel) (1) Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
F108-CF-100														
Idle	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Approach	1.50E-02	0.00E+00	0.00E+00	0.00E+00	3.22E-03	6.23E-03	5.53E-04	1.61E-03	0.00E+00	1.85E-03	8.63E-04	7.63E-04	4.46E-02	3.81E-03
Intermediate	5.58E-03	0.00E+00	0.00E+00	0.00E+00	4.25E-04	1.42E-03	0.00E+00	5.42E-04	0.00E+00	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
Military	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03
P&W 4062 (3)														
Idle	1.78E+00	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Approach	1.48E-02	5.13E-03	2.94E-03	6.50E-04	2.02E-03	7.71E-04	2.09E-04	3.39E-04	3.71E-04	1.85E-03	8.63E-04	7.63E-04	4.46E-02	3.81E-03
Intermediate	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
Military	1.31E-02	4.56E-03	2.61E-03	5.78E-04	1.79E-03	6.85E-04	1.86E-04	3.01E-04	3.30E-04	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03

Notes: (1) Data are for one engine. The KC-135R has 4 engines and the KC-46A has 2 engines.
(2) Data from *Air Emissions Factor Guide to Air Force Mobile Sources* (AFCEC 2013), Table 2-9.

Table D3.5-3. Land and Take-off/Touch and Go Times in Mode and Fuel Usages - KC-135 and KC-46A Aircraft

	LTO			Touch & Go	
	Time in Mode (TIM)		Fuel Usage	TIM	Fuel Usage
Aircraft/Mode (Engine Throttle Setting)	Minutes	Hours	Pounds	Hours	Pounds
KC-135 (2)					
Taxi Out (Idle)	32.8	0.55	2217		
Take-off (Military)	0.7	0.01	364	0.01	364
Climbout (Intermediate)	2.5	0.04	1081	0.04	1081
Approach	5.2	0.09	854	0.09	854
Taxi In (Idle)	14.9	0.25	1007		
Totals	56.1	0.94	5523	0.14	2299
KC-46A (2)					
Taxi Out (Idle)	32.8	0.55	1818		
Take-off (Military)	0.7	0.01	505	0.01	505
Climbout (Intermediate)	2.5	0.04	1406	0.04	1406
Approach	5.2	0.09	988	0.09	988
Taxi In (Idle)	14.9	0.25	826		
Totals	56.1	0.94	5543	0.14	2899
APU Use, KC-46A (3)		Hours			
Pre-Flight - OBIGGS + Electric + Max ECS		1.50			
Pre-Flight - Main Engine Start + Electric		0.03			
Post-Flight - Electric + Min ECS		0.58			
Total Hours per LTO		2.12			

Notes: (1) Fuel usage per aircraft.

(2) TIM Data from Table 2-4, Transport Aircraft (AFCEC 2013).

(3) APU use from FTU/MOB1 Draft EIS.

Table D3.5-4. Land and Take-off/Touch and Go Total Fuel Usages and Emissions - KC-135 and KC-46A Aircraft

Aircraft/Mode	LTO			Emissions (Pounds)								
LTOs	Time in Mode (TIM)		Fuel Usage	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
	Minutes	Hours	Pounds									
KC-135 (2)												
Taxi Out (Idle)	32.8	0.55	2217	4.67	68.05	8.87	2.35	0.13	0.13	7129.08	0.20	0.22
Take-off (Military)	0.7	0.01	364	0.02	0.03	6.74	0.39	0.03	0.03	1170.80	0.03	0.04
Climbout (Intermediate)	2.5	0.04	1081	0.06	0.10	17.30	1.15	0.05	0.05	3476.75	0.10	0.11
Approach	5.2	0.09	854	0.08	3.59	7.00	0.91	0.05	0.05	2746.08	0.08	0.09
Taxi In (Idle)	14.9	0.25	1007	2.12	30.91	4.03	1.07	0.06	0.06	3238.52	0.09	0.10
Totals	56.1	0.935	5523	6.94	102.69	43.93	5.85	0.32	0.32	17761.24	0.49	0.55
KC-46A (2)												
Taxi Out (Idle)	32.8	0.55	1818	22.71	77.48	6.87	1.93	0.20	0.18	5848.08	0.16	0.18
Take-off (Military)	0.7	0.01	505	0.05	0.31	17.33	0.53	0.04	0.04	1622.48	0.04	0.05
Climbout (Intermediate)	2.5	0.04	1406	0.11	0.70	36.52	1.49	0.10	0.08	4521.05	0.13	0.14
Approach	5.2	0.09	988	0.10	1.91	12.03	1.05	0.05	0.04	3178.75	0.09	0.10
Taxi In (Idle)	14.9	0.25	826	10.32	35.20	3.12	0.88	0.09	0.08	2656.60	0.07	0.08
Totals	56.1	0.935	5543	33.29	115.60	75.88	5.88	0.48	0.42	17826.96	0.49	0.55

Aircraft/Mode	Touch and Go			Emissions (Pounds)								
Touch and Go	Time in Mode (TIM)		Fuel Usage	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
	Minutes	Hours	Pounds									
KC-135 (2)												
Take-off (Military)	0.70	0.01	364	0.02	0.03	6.74	0.39	0.03	0.03	1170.80	0.03	0.04
Climbout (Intermediate)	2.50	0.04	1081	0.06	0.10	17.30	1.15	0.05	0.05	3476.75	0.10	0.11
Approach	5.20	0.09	854	0.08	3.59	7.00	0.91	0.05	0.05	2746.08	0.08	0.09
Totals	8.40	0.14	2299	0.16	3.72	31.03	2.44	0.13	0.13	7393.64	0.20	0.23
KC-46A (2)												
Take-off (Military)	0.7	0.01	505	0.05	0.31	17.33	0.53	0.04	0.04	1622.48	0.04	0.05
Climbout (Intermediate)	2.5	0.04	1406	0.11	0.70	36.52	1.49	0.10	0.08	4521.05	0.13	0.14
Approach	5.2	0.09	988	0.10	1.91	12.03	1.05	0.05	0.04	3178.75	0.09	0.10
Totals	8.40	0.14	2899	0.26	2.92	65.89	3.07	0.19	0.16	9322.28	0.26	0.29

Table D3.5-5. Land and Take-off/Touch and Go Total Fuel Usages and HAP Emissions - KC-135 and KC-46A Aircraft

Aircraft/Mode	LTO			Emissions (Pounds)													
LTOs	Time in Mode (TIM)		Fuel Usage	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
	Minutes	Hours	Pounds														
KC-135 (2)																	
Taxi Out (Idle)	32.8	0.55	2217	0.21	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.15	0.01
Take-off (Military)	0.7	0.01	364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1081	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Approach	5.2	0.09	854	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Taxi In (Idle)	14.9	0.25	1007	0.10	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Totals	56.1	0.94	5523	0.33	0.00	0.00	0.01	0.01	0.04	0.00	0.01	0.00	0.01	0.00	0.00	0.31	0.02
KC-46A (2)																	
Taxi Out (Idle)	32.8	0.55	1818	3.24	1.13	0.65	0.14	0.44	0.17	0.05	0.07	0.08	0.01	0.00	0.00	0.12	0.01
Take-off (Military)	0.7	0.01	505	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1406	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Approach	5.2	0.09	988	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Taxi In (Idle)	14.9	0.25	826	1.47	0.51	0.29	0.06	0.20	0.08	0.02	0.03	0.04	0.00	0.00	0.00	0.06	0.00
Totals	56.1	0.94	5543	4.75	1.65	0.95	0.21	0.65	0.25	0.07	0.11	0.12	0.01	0.00	0.00	0.29	0.02

Aircraft/Mode	Touch and Go			Emissions (Pounds)													
Touch and Go	Time in Mode (TIM)		Fuel Usage	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
	Minutes	Hours	Pounds														
KC-135 (2)																	
Take-off (Military)	0.70	0.01	364	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.50	0.04	1081	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
Approach	5.20	0.09	854	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Totals	8.40	0.14	2299	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.01
KC-46A (2)																	
Take-off (Military)	0.7	0.01	505	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Climbout (Intermediate)	2.5	0.04	1406	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.07	0.00
Approach	5.2	0.09	988	0.01	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.00
Totals	8.40	0.14	2899	0.04	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.12	0.01

Table D3.5-6. Annual Air Operations for Aircraft at Rickenbacker - Baseline

	Number of Operations		
Aircraft	LTO	TGO	Total
KC-135	1289	1933.5	6445

Table D3.5-7. KC-135 Aircraft Closed Pattern Operations at Rickenbacker, Baseline

Scenario/Operation	Operations/Year: Fraction of Ops	Operations/Year: Total Ops per Pattern	Engine Setting/Time in Mode per Operation (Minutes): 55%	58%	60%	70%	73%	85%
KC-136 VFR Profile	1	1934	1.08073231	1.05954148	3.23876605	0.6250811	0.10721551	0.60319134
KC-135 IFR Profile	0	0	5.90400061	2.76893508	3.98841687	0.45137435	0.10721551	0.60319134
Total Ops		1933.5						

Table D3.5-8. KC-135 Aircraft Closed Pattern Operations - Fuel Use and Emission Factors, Baseline

Factor			Engine Setting/Time in Mode per Operation (Minutes): 55%	58%	60%	70%	73%	85%
Fuel Use, lbs/hr			19910.88	20916.72	21922.56	25945.92	27589.32	31204.8
Emission Factors, lbs/1000 lbs fuel								
VOC			0.0704	0.0683	0.0661	0.0575	0.0539	0.0460
CO			1.6313	1.3744	1.1175	0.0900	0.0900	0.0900
NOx			13.0750	13.5625	14.0500	16.0000	16.7813	18.5000
SO2			1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
PM10			0.0538	0.0531	0.0525	0.0500	0.0563	0.0700
PM2.5			0.0538	0.0531	0.0525	0.0500	0.0563	0.0700
CO2			3216	3216	3216	3216	3216	3216
CH4			0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
N2O			0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

Table D3.5-9. KC-135 Aircraft Closed Pattern Operations - Emissions Per Operation, Baseline

Emissions per operation, lbs			VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-135 CA VFR Right Turns South Side			0.1614	2.4721	37.2809	2.6974	0.1393	0.1393	8183.7166	0.2265	0.2545
KC-135 CC IFR Right Turns Southwest Side			0.3286	6.2014	68.9372	5.2364	0.2676	0.2676	15886.9857	0.4397	0.4940
Emissions, closed pattern ops, tons/year			0.1560	2.3899	36.0413	2.6077	0.1346	0.1346	7911.6080	0.2189	0.2460

Table D3.5-10. Annual Air Emissions for KC-135 Aircraft Operations at Rickenbacker - Baseline

Aircraft	Annual Emissions, Tons/year								
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-135 LTOs	4.47	66.18	28.31	3.77	0.21	0.21	11447.12	0.32	0.36
KC-135 T&G	0.16	2.39	36.04	2.61	0.13	0.13	7911.61	0.22	0.25
Total Existing	4.63	68.57	64.35	6.38	0.34	0.34	19358.73	0.54	0.60

Table D3.5-11. Annual HAP Emissions for KC-135 Aircraft Operations at Rickenbacker - Baseline

Aircraft	Annual Emissions, Tons/year													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-135 LTOs	0.21	0.00	0.00	0.01	0.01	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.20	0.01
KC-135 Closed Pattern Ops	0.02	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.09	0.01
Total Existing	0.23	0.00	0.00	0.01	0.01	0.03	0.00	0.01	0.00	0.01	0.00	0.00	0.29	0.02

Table D3.5-12. JP-8 AGE Equipment Emissions, Rickenbacker, Baseline

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/hr						Annual Emissions (lbs/yr)					
						NOx	CO	VOC	PM10	PM2.5	SO2	NOx	CO	VOC	PM10	PM2.5	SO2
KC-135 AGE																	
Sorties:	1289																
	Hours/Sortie																
Generator A/M32A-86	10	12890.00	6.47	107693.87	148	6.10E+00	4.57E-01	2.94E-01	9.10E-02	8.90E-02	4.60E-02	1.73E+02	1.30E+01	8.35E+00	2.59E+00	2.53E+00	1.31E+00
Start Cart A/M32A-60A	1	1289.00	10.16	13097.90	180	1.82E+00	5.48E+00	2.70E-01	2.11E-01	2.05E-01	7.18E-02	5.17E+00	1.56E+01	7.67E-01	6.00E-01	5.83E-01	2.04E-01
Start Cart A/M32A-95	0.1	128.90	8.75	1127.88	155	1.47E+00	5.86E+00	7.00E-01	1.10E-01	1.07E-01	6.19E-02	4.18E-01	1.67E+00	1.99E-01	3.13E-02	3.04E-02	1.76E-02
Heater/AC Ace 802-993 AC	10	12890.00	6.80	197923.87	272	2.94E+00	1.50E-01	2.04E-01	1.98E-01	1.92E-01	4.80E-02	8.35E+01	4.26E+00	5.80E+00	5.63E+00	5.46E+00	1.36E+00
MA-3C Air Conditioner	2	2578.00	7.12	17463.87	120	4.17E+00	3.17E-01	5.30E-02	1.09E-01	1.05E-01	5.00E-02	2.37E+01	1.80E+00	3.01E-01	6.20E-01	5.97E-01	2.84E-01
H1	5	6445.00	0.39	2364.90	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	2.25E+00	2.57E+00	1.42E+00	1.55E+00	1.55E+00	4.26E-02
1H1	4	5156.00	0.39	1891.92	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.80E+00	2.06E+00	1.14E+00	1.24E+00	1.24E+00	3.41E-02
Light Cart NF-2	2	2578.00	1.02	2619.58	18	1.10E-01	8.00E-02	1.00E-02	1.00E-02	1.00E-02	7.18E-03	6.25E-01	4.55E-01	5.68E-02	5.68E-02	5.68E-02	4.08E-02
Air Compressor MC-1A	0.33	425.37	1.09	441.84	18.4	4.19E-01	2.67E-01	2.67E-01	7.10E-02	6.80E-02	8.00E-03	3.93E-01	2.50E-01	2.50E-01	6.66E-02	6.38E-02	7.50E-03
Total JP-8 AGE, Tons/year				hp-hrs	6104796.808							1.46E-01	2.08E-02	9.14E-03	6.19E-03	6.05E-03	1.65E-03

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.5-13. AGE HAP Emissions, Rickenbacker, Baseline

Pollutant	JP-8			Gasoline	
	Emission Factors		Actual Annual Emissions (lbs/yr)	Emission Factor (lb/MMBTU)	Annual Emissions (lbs/yr)
	Turbine (lb/1000 gal)	Reciprocating (lb/1000 hp-hr)			
Arsenic	1.53E-03				
Acetaldehyde		5.40E-03	3.30E+01	7.00E-02	
Acrolein		6.48E-04	3.96E+00		
Benzene	7.65E-03	6.50E-03	3.97E+01		
Beryllium	4.31E-05				
1,3-Butadiene	2.22E-03	2.74E-04	1.67E+00		
Cadmium	6.67E-04				
Chromium	1.53E-03				
Formaldehyde	3.89E-02	8.30E-03	5.07E+01		
Lead	1.95E-03				
Manganese	1.10E-01				
Mercury	1.67E-04				
Maphthalene	4.87E-03	5.94E-04	3.63E+00		
Nickel	6.39E-04				
POM	5.56E-03	1.20E-03	7.33E+00		
Selenium	3.48E-03				
Toluene		2.90E-03	1.77E+01		
Xylenes		2.00E-03	1.22E+01		
Total			1.50E-02		

Table D3.5-14. JP-8 AGE Equipment GHG Emissions, Rickenbacker, Baseline

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/gal			Annual Emissions (lbs/yr)		
						CO2	CH4	N2O	CO2	CH4	N2O
KC-135 AGE											
Sorties:	1289										
	Hours/Sortie										
Generator A/M32A-86	10	12890.00	6.47	107693.87	148	2.11E+01	5.91E-04	6.80E-04	2.27E+06	6.36E+01	7.32E+01
Start Cart A/M32A-60A	1	1289.00	10.16	13097.90	180	2.11E+01	5.91E-04	6.80E-04	2.76E+05	7.74E+00	8.91E+00
Start Cart A/M32A-95	0.1	128.90	8.75	1127.88	155	2.11E+01	5.91E-04	6.80E-04	2.38E+04	6.67E-01	7.67E-01
Heater/AC Ace 802-993 AC	10	12890.00	6.80	197923.87	272	2.11E+01	5.91E-04	6.80E-04	4.18E+06	1.17E+02	1.35E+02
MA-3C Air Conditioner	2	2578.00	7.12	17463.87	120	2.11E+01	5.91E-04	6.80E-04	3.68E+05	1.03E+01	1.19E+01
H1	5	6445.00	0.39	2364.90	6.5	2.11E+01	5.91E-04	6.80E-04	4.99E+04	1.40E+00	1.61E+00
1H1	4	5156.00	0.39	1891.92	6.5	2.11E+01	5.91E-04	6.80E-04	3.99E+04	1.12E+00	1.29E+00
Light Cart NF-2	2	2578.00	1.02	2619.58	18	2.11E+01	5.91E-04	6.80E-04	5.53E+04	1.55E+00	1.78E+00
Air Compressor MC-1A	0.33	425.37	1.09	441.84	18.4	2.11E+01	5.91E-04	6.80E-04	9.32E+03	2.61E-01	3.00E-01
Total JP-8 AGE, Metric Tons/year									3.30E+03	9.24E-02	1.06E-01

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.5-15. Aircraft Engine Emissions - Engine Tests, Rickenbacker, Baseline

						Emission Factors (lb/1000 lb fuel)						Emissions (lbs/yr)					
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	VOC	CO	NOx	SO2	PM10	PM2.5	VOC	CO	NOx	SO2	PM10	PM2.5
KC-135																	
Defueling	16	Idle	0.50	1	1,014	2.1	30.7	4.0	1.1	0.1	0.1	17.07	248.98	32.44	8.60	0.99	0.99
Maintenance Run	64	Idle	0.33	4	1,014	2.1	30.7	4.0	1.1	0.1	0.1	182.06	2,655.78	346.03	91.70	10.54	10.54
TRT Run 2 Engine	7	Idle	0.17	2	1,014	2.1	30.7	4.0	1.1	0.1	0.1	4.98	72.62	9.46	2.51	0.29	0.29
	7	80% RPM	0.08	2	7801.2	0.0	0.1	18.5	1.1	0.1	0.1	0.42	0.82	168.38	9.65	1.00	1.00
TRT Run 4 Engine	6	Idle	0.17	4	1,014	2.1	30.7	4.0	1.1	0.1	0.1	8.53	124.49	16.22	4.30	0.49	0.49
	6	80% RPM	0.08	4	7801.2	0.0	0.1	18.5	1.1	0.1	0.1	0.72	1.40	288.64	16.54	1.71	1.71
												0.11	1.55	0.43	0.07	0.01	0.01

Table D3.5-16. HAP Emissions, Engine Tests, Rickenbacker, Baseline

						Emission Factor (lb/1000 lb fuel) (1)													
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-135																			
Defueling	16	Idle	0.50	1	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
Maintenance Run	64	Idle	0.33	4	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
TRT Run 2 Engine	7	Idle	0.17	2	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
	7	80% RPM	0.08	2	7801.2	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03
TRT Run 4 Engine	6	Idle	0.17	4	1,014	9.51E-02	0.00E+00	0.00E+00	2.90E-03	1.90E-03	8.97E-03	6.84E-04	1.65E-03	1.48E-03	2.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03
	6	80% RPM	0.08	4	7801.2	7.01E-03	0.00E+00	0.00E+00	0.00E+00	1.11E-03	1.11E-03	0.00E+00	3.36E-04	0.00E+00	1.18E-03	3.37E-04	4.84E-04	1.96E-03	2.42E-03

Emissions, lbs/yr														
Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate	Total HAPs, TPY
0.77	0.00	0.00	0.02	0.02	0.07	0.01	0.01	0.01	0.02	0.01	0.01	0.55	0.04	
8.23	0.00	0.00	0.25	0.16	0.78	0.06	0.14	0.13	0.20	0.08	0.08	5.84	0.42	
0.22	0.00	0.00	0.01	0.00	0.02	0.00	0.00	0.00	0.01	0.00	0.00	0.16	0.01	
0.06	0.00	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.00	0.00	0.02	0.02	
0.39	0.00	0.00	0.01	0.01	0.04	0.00	0.01	0.01	0.01	0.00	0.00	0.27	0.02	
0.11	0.00	0.00	0.00	0.02	0.02	0.00	0.01	0.00	0.02	0.01	0.01	0.03	0.04	
0.00489095	0	0	0.000146505	0.0001097	0.00046687	3.4555E-05	8.7507E-05	7.4768E-05	0.000131274	5.02865E-05	5.48808E-05	0.00343424	0.00027491	0.00975644

Table D3.5-17. GHG Emissions, Engine Tests, Rickenbacker, Baseline

						Emission Factor(1)					
						CO2	CH4	N2O	Actual Emissions (lb/yr)		
Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	(lb/1000 lb fuel)	(lb/1000 lb fuel)	(lb/1000 lb fuel)	CO2	CH4	N2O
KC-135											
Defueling	16	Idle	0.50	1	1,014	3,216.0	0.1	0.1	26,082.02	0.72	0.81
Maintenance Run	64	Idle	0.33	4	1,014	3,216.0	0.1	0.1	278,208.18	7.70	8.65
TRT Run 2 Engine	7	Idle	0.17	2	1,014	3,216.0	0.1	0.1	7,607.26	0.21	0.24
	7	80% RPM	0.08	2	7801.2	3,216.0	0.1	0.1	29,270.10	0.81	0.91
TRT Run 4 Engine	6	Idle	0.17	4	1,014	3,216.0	0.1	0.1	13,041.01	0.36	0.41
	6	80% RPM	0.08	4	7801.2	3,216.0	0.1	0.1	50,177.32	1.39	1.56
Total, tpy									183	0.01	0.01

(1) CO2 emission factors obtained from AFCEC 2013.
CH4 and N2O emission factors were derived from Table A-101 for jet fuel in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005, using density of JP-8 as 6.8 lb/gallon.

Table D3.5-18. Annual Worker Population and VMT at Rickenbacker - KC-46A Project Scenarios

Scenario	Total # of Workers	Annual On-Base VMT	Annual Off-Base VMT
Existing	1174	305240	4993726.4
Proposed Action	1358	353080	5776388.8

[1]On-Base mileage based on 1.00 miles from 2009 AEI; assume 260 days/year

[2]Off-Base mileage based on distance to downtown Columbus, 16.36 miles; assume 260 days/year

Table D3.5-19. Annual Average On-Road Vehicle Emission Factors - Rickenbacker

		Emission Factors (Grams/Mile)						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	0.589	10.11	0.445	0.007	0.025	0.011	368.1
LDDT	0.03	0.132	0.808	0.2	0.003	0.053	0.037	314
LDGT	60.32	0.833	11.95	0.701	0.01	0.025	0.011	516.1
LDDT	0.2	0.393	0.708	0.46	0.006	0.06	0.044	599.2
HDGV	0	1.078	28.36	1.206	0.017	0.049	0.032	905.3
HDDV	0	0.684	2.315	3.359	0.012	0.129	0.1	1245.6
MC	1.9	2.85	27.61	0.86	0.003	0.037	0.021	177.4
Proposed Action (Year 2018) (1)								
LDGV	37.55	0.448	9.22	0.318	0.007	0.025	0.011	368
LDDT	0.03	0.087	0.692	0.088	0.003	0.038	0.023	314.1
LDGT	60.32	0.782	10.43	0.527	0.01	0.025	0.011	516.6
LDDT	0.2	0.305	0.6	0.317	0.006	0.047	0.032	598.6
HDGV	0	0.305	26.67	0.68	0.017	0.04	0.025	904
HDDV	0	0.583	1.428	1.919	0.012	0.078	0.053	1245.9
MC	1.9	2.85	27.61	0.86	0.003	0.037	0.021	177.4

Notes: (1) Emission factors from AFCEC 2013, Table 5-13, for 2017 used to provide a conservative estimate of emissions for 2018

Table D3.5-20. Annual Average On-Base Vehicle Emissions, Rickenbacker

		Emissions, lbs/year						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	148.83	2554.70	112.45	1.77	6.32	2.78	93015.16
LDDT	0.03	0.03	0.16	0.04	0.00	0.01	0.01	63.39
LDGT	60.32	338.13	4850.73	284.55	4.06	10.15	4.47	209494.76
LDDT	0.2	0.53	0.95	0.62	0.01	0.08	0.06	806.45
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	36.44	353.02	11.00	0.04	0.47	0.27	2268.22
Total Existing, tons/year		0.26	3.88	0.20	0.00	0.01	0.00	152.82
Proposed Action (Year 2018) (1)								
LDGV	37.55	130.95	2694.95	92.95	2.05	7.31	3.22	107564.11
LDDT	0.03	0.02	0.16	0.02	0.00	0.01	0.01	73.35
LDGT	60.32	367.18	4897.28	247.45	4.70	11.74	5.16	242563.46
LDDT	0.2	0.47	0.93	0.49	0.01	0.07	0.05	931.92
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	42.15	408.35	12.72	0.04	0.55	0.31	2623.72
Total Proposed Action, tons/year		0.27	4.00	0.18	0.00	0.01	0.00	176.88

Table D3.5-21. Annual Average Off-Base Vehicle Emissions, Rickenbacker

		Emissions, lbs/year						
Scenario/Vehicle Class	POV Mix (%)	VOC	CO	NOx	SO2	PM10	PM2.5	CO2
Existing (Year 2013)								
LDGV	37.55	2434.93	41794.81	1839.63	28.94	103.35	45.47	1521728.00
LDDT	0.03	0.44	2.67	0.66	0.01	0.18	0.12	1037.08
LDGT	60.32	5531.81	79357.96	4655.22	66.41	166.02	73.05	3427334.28
LDDT	0.2	8.65	15.59	10.13	0.13	1.32	0.97	13193.59
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	596.16	5775.39	179.89	0.63	7.74	4.39	37108.08
Total Existing, tons/year		4.29	63.47	3.34	0.05	0.14	0.06	2500.20
Proposed Action (Year 2018) (1)								
LDGV	37.55	1852.04	38115.55	1314.61	28.94	103.35	45.47	1521314.60
LDDT	0.03	0.29	2.29	0.29	0.01	0.13	0.08	1037.41
LDGT	60.32	5193.13	69263.90	3499.72	66.41	166.02	73.05	3430654.70
LDDT	0.2	6.72	13.21	6.98	0.13	1.03	0.70	13180.38
HDGV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
HDDV	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MC	1.9	596.16	5775.39	179.89	0.63	7.74	4.39	37108.08
Total Proposed Action, tons/year		3.82	56.59	2.50	0.05	0.14	0.06	2501.65

Table D3.5-22. Annual Air Operations for Aircraft at Rickenbacker - Proposed Action

	Number of Operations		
Aircraft	LTO	TGO	Total
KC-46A	1286	2142.5	6857

Table D3.5-23. KC-46A Aircraft Closed Pattern Operations at Rickenbacker - KC-46A Proposed Scenarios

	Operations/Year		Engine Setting/Time in Mode per Operation (Minutes)						
Scenario/Operation	Fraction of Ops	Total Ops per Pattern	55%	58%	60%	68%	73%	83%	85%
KC-46A VFR Profile	1	2143	1.52770185	1.04541426	2.57545944	0.66856113	0.06861792	0.3602441	0.39626852
KC-46A IFR Profile	0	0	5.24755579	1.03333177	6.83322258	1.16386557	0.06861792	0.39455307	0.33222512
Total Ops		2143							

Table D3.5-24. KC-46A Aircraft Closed Pattern Operations - Fuel Use and Emission Factors

			Engine Setting/Time in Mode per Operation (Minutes)						
Factor			55%	58%	60%	68%	73%	83%	85%
Fuel Use, lbs/hr			22572	23688.8	24805.6	28379.36	30389.6	34928	36116
Emission Factors, lbs/1000 lbs									
VOC			0.0920	0.0909	0.0897	0.0860	0.0840	0.0819	0.0834
CO			1.2150	1.1435	1.0720	0.8432	0.7145	0.5138	0.5275
NOx			19.0750	19.7655	20.4560	22.6656	23.9085	27.0275	28.0750
SO2			1.0600	1.0600	1.0600	1.0600	1.0600	1.0600	1.0600
PM10			0.0600	0.0610	0.0620	0.0652	0.0670	0.0713	0.0725
PM2.5			0.0500	0.0510	0.0520	0.0552	0.0570	0.0613	0.0625
CO2			3216	3216	3216	3216	3216	3216	3216
CH4			0.0890	0.0890	0.0890	0.0890	0.0890	0.0890	0.0890
N2O			0.1000	0.1000	0.1000	0.1000	0.1000	0.1000	0.1000

Table D3.5-25. KC-46A Aircraft Closed Pattern Operations - Emissions Per Operation

Emissions per operation, lbs			VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-46A CA VFR Right Turns South Side			0.2531	2.8367	61.2646	3.0225	0.1809	0.1523	9170.2396	0.2538	0.2851
KC-46A CC IFR Right Turns Southwest Side			0.5579	6.6060	128.6396	6.5954	0.3876	0.3254	20010.1143	0.5538	0.6222
Emissions, closed pattern ops, tons/year			0.2711	3.0388	65.6297	3.2379	0.1937	0.1632	9823.6192	0.2719	0.3055

Table D3.5-26. Annual Air Emissions for KC-46A Aircraft Operations at Rickenbacker - Proposed Action

Aircraft	Annual Emissions, Tons/year								
	VOC	CO	NOx	SO2	PM10	PM2.5	CO2	CH4	N2O
KC-46A LTOs	21.40	74.33	48.79	3.78	0.31	0.27	11462.73	0.32	0.36
KC-46A T&G	0.27	3.04	65.63	3.24	0.19	0.16	9823.62	0.27	0.31
APU	0.05	0.45	9.16	0.76	0.07	0.05	1871.62	0.00	0.00
Total Proposed Action	21.73	77.82	123.58	7.78	0.57	0.49	23157.97	0.59	0.66

Table D3.5-27. Annual HAP Emissions for KC-46A Aircraft Operations at Forbes - Proposed Action

Aircraft	Annual Emissions, Tons/year													
	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-46A LTOs	3.06	1.06	0.61	0.13	0.42	0.16	0.04	0.07	0.08	0.01	0.00	0.00	0.19	0.01
KC-46A Closed Pattern Ops	0.04	0.01	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.00	0.12	0.01
Total Proposed Action	3.10	1.07	0.62	0.14	0.42	0.16	0.04	0.07	0.08	0.01	0.01	0.00	0.31	0.02

Table D3.5-28. JP-8 AGE Equipment Emissions, Rickenbacker, Proposed Action

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/hr						Annual Emissions (lbs/yr)					
						NOx	CO	VOC	PM10	PM2.5	SO2	NOx	CO	VOC	PM10	PM2.5	SO2
KC-46A AGE																	
Sorties:	1286																
	Hours/Sortie																
Generator A/M32A-86	10	12860.00	6.47	107443.23	148	6.10E+00	4.57E-01	2.94E-01	9.10E-02	8.90E-02	4.60E-02	1.73E+02	1.30E+01	8.34E+00	2.58E+00	2.52E+00	1.30E+00
Start Cart A/M32A-60A	1	1286.00	10.16	13067.42	180	1.82E+00	5.48E+00	2.70E-01	2.11E-01	2.05E-01	7.18E-02	5.16E+00	1.55E+01	7.65E-01	5.98E-01	5.81E-01	2.04E-01
Start Cart A/M32A-95	0.1	128.60	8.75	1125.25	155	1.47E+00	5.86E+00	7.00E-01	1.10E-01	1.07E-01	6.19E-02	4.17E-01	1.66E+00	1.98E-01	3.12E-02	3.03E-02	1.75E-02
Heater/AC Ace 802-993 AC	10	12860.00	6.80	197463.23	272	2.94E+00	1.50E-01	2.04E-01	1.98E-01	1.92E-01	4.80E-02	8.33E+01	4.25E+00	5.78E+00	5.61E+00	5.44E+00	1.36E+00
MA-3C Air Conditioner	2	2572.00	7.12	17423.23	120	4.17E+00	3.17E-01	5.30E-02	1.09E-01	1.05E-01	5.00E-02	2.36E+01	1.80E+00	3.01E-01	6.18E-01	5.95E-01	2.84E-01
H1	5	6430.00	0.39	2359.40	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	2.24E+00	2.57E+00	1.42E+00	1.55E+00	1.55E+00	4.25E-02
1H1	4	5144.00	0.39	1887.52	6.5	1.58E-01	1.81E-01	1.00E-01	1.09E-01	1.09E-01	3.00E-03	1.79E+00	2.05E+00	1.13E+00	1.24E+00	1.24E+00	3.40E-02
Light Cart NF-2	2	2572.00	1.02	2613.48	18	1.10E-01	8.00E-02	1.00E-02	1.00E-02	1.00E-02	7.18E-03	6.24E-01	4.54E-01	5.67E-02	5.67E-02	5.67E-02	4.07E-02
Air Compressor MC-1A	0.33	424.38	1.09	440.81	18.4	4.19E-01	2.67E-01	2.67E-01	7.10E-02	6.80E-02	8.00E-03	3.92E-01	2.50E-01	2.50E-01	6.64E-02	6.36E-02	7.48E-03
Total JP-8 AGE, Tons/year				hp-hrs	6090588.592							1.45E-01	2.08E-02	9.12E-03	6.17E-03	6.04E-03	1.65E-03

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.5-29. AGE HAP Emissions, Rickenbacker, Proposed Action

Pollutant	JP-8			Gasoline	
	Emission Factors		Actual Annual Emissions (lbs/yr)	Emission Factor (lb/MMBTU)	Annual Emissions (lbs/yr)
	Turbine (lb/1000 gal)	Reciprocating (lb/1000 hp-hr)			
Arsenic	1.53E-03				
Acetaldehyde		5.40E-03	3.29E+01	7.00E-02	
Acrolein		6.48E-04	3.95E+00		
Benzene	7.65E-03	6.50E-03	3.96E+01		
Beryllium	4.31E-05				
1,3-Butadiene	2.22E-03	2.74E-04	1.67E+00		
Cadmium	6.67E-04				
Chromium	1.53E-03				
Formaldehyde	3.89E-02	8.30E-03	5.06E+01		
Lead	1.95E-03				
Manganese	1.10E-01				
Mercury	1.67E-04				
Maphthalene	4.87E-03	5.94E-04	3.62E+00		
Nickel	6.39E-04				
POM	5.56E-03	1.20E-03	7.31E+00		
Selenium	3.48E-03				
Toluene		2.90E-03	1.77E+01		
Xylenes		2.00E-03	1.22E+01		
Total			1.49E-02		

Table D3.5-30. JP-8 AGE Equipment GHG Emissions, Rickenbacker, Proposed Action

AGE Type	Sorties	Total Run Time (hr/yr)	Fuel Use per Unit (gal/hr)	Fuel Use per Unit (gal/yr)	Engine Rating (hp)	Emission Factors, lbs/gal			Annual Emissions (lbs/yr)		
						CO2	CH4	N2O	CO2	CH4	N2O
KC-46A AGE											
Sorties:	1286										
	Hours/Sortie										
Generator A/M32A-86	10	12860.00	6.47	107443.23	148	2.11E+01	5.91E-04	6.80E-04	2.27E+06	6.35E+01	7.31E+01
Start Cart A/M32A-60A	1	1286.00	10.16	13067.42	180	2.11E+01	5.91E-04	6.80E-04	2.76E+05	7.72E+00	8.89E+00
Start Cart A/M32A-95	0.1	128.60	8.75	1125.25	155	2.11E+01	5.91E-04	6.80E-04	2.37E+04	6.65E-01	7.65E-01
Heater/AC Ace 802-993 AC	10	12860.00	6.80	197463.23	272	2.11E+01	5.91E-04	6.80E-04	4.17E+06	1.17E+02	1.34E+02
MA-3C Air Conditioner	2	2572.00	7.12	17423.23	120	2.11E+01	5.91E-04	6.80E-04	3.68E+05	1.03E+01	1.18E+01
H1	5	6430.00	0.39	2359.40	6.5	2.11E+01	5.91E-04	6.80E-04	4.98E+04	1.39E+00	1.60E+00
1H1	4	5144.00	0.39	1887.52	6.5	2.11E+01	5.91E-04	6.80E-04	3.98E+04	1.12E+00	1.28E+00
Light Cart NF-2	2	2572.00	1.02	2613.48	18	2.11E+01	5.91E-04	6.80E-04	5.51E+04	1.54E+00	1.78E+00
Air Compressor MC-1A	0.33	424.38	1.09	440.81	18.4	2.11E+01	5.91E-04	6.80E-04	9.30E+03	2.61E-01	3.00E-01
Total JP-8 AGE, Metric Tons/year									3.29E+03	9.22E-02	1.06E-01

Emission estimation methodology based AFCEC 2013, assuming Sortie/LTO method per AFCEC guidance.

Equipment from AFCEC 2013, Table 3-3. Emission Factors from AFCEC 2013, Table 3-4.

Table D3.5-31. Aircraft Engine Emissions - Engine Tests, Rickenbacker, Proposed Action

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factors (lb/1000 lb fuel)						Emissions (lbs/yr)					
						VOC	CO	NOx	SO2	PM10	PM2.5	VOC	CO	NOx	SO2	PM10	PM2.5
KC-46A																	
Defueling	17	Idle	0.50	1	1,663	12.5	42.6	3.8	1.1	0.1	0.1	176.56	602.39	53.44	14.99	1.56	1.41
Maintenance Run	68	Idle	0.33	2	1,663	12.5	42.6	3.8	1.1	0.1	0.1	941.65	3,212.73	285.01	79.92	8.29	7.54
TRT Run 1 Engine	8	Idle	0.17	1	1,663	12.5	42.6	3.8	1.1	0.1	0.1	27.70	94.49	8.38	2.35	0.24	0.22
	8	80% RPM	0.08	1	16869.6	0.1	0.5	26.0	1.1	0.1	0.1	0.91	5.62	292.18	11.92	0.79	0.67
TRT Run 2 Engine	6	Idle	0.17	2	1,663	12.5	42.6	3.8	1.1	0.1	0.1	41.54	141.74	12.57	3.53	0.37	0.33
	6	80% RPM	0.08	2	16869.6	0.1	0.5	26.0	1.1	0.1	0.1	1.36	8.43	438.27	17.88	1.18	1.01
												0.59	2.03	0.54	0.07	0.01	0.01

Table D3.5-32. HAP Emissions, Engine Tests, Rickenbacker, Proposed Action

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factor (lb/1000 lb fuel) (1)													
						Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
KC-46A																			
Defueling	17	Idle	0.50	1	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
Maintenance Run	68	Idle	0.33	2	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
TRT Run 2 Engine	8	Idle	0.17	1	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
	8	80% RPM	0.08	1	16869.6	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03
TRT Run 4 Engine	6	Idle	0.17	2	1,663	6.19E-01	3.55E-01	7.84E-02	2.44E-01	9.30E-02	2.52E-02	4.09E-02	4.48E-02	3.31E-03	9.13E-04	9.68E-04	6.75E-02	4.85E-03	4.85E-03
	6	80% RPM	0.08	2	16869.6	1.15E-02	3.99E-03	2.29E-03	5.05E-04	1.57E-03	6.00E-04	1.63E-04	2.63E-04	2.89E-04	1.76E-03	7.94E-04	5.09E-04	5.06E-02	2.54E-03

Emissions, lbs/yr														
Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate	Total HAPs, TPY
8.75	5.02	1.11	3.44	1.32	0.36	0.58	0.63	0.05	0.01	0.01	0.95	0.07	0.07	
46.66	26.75	5.91	18.37	7.01	1.90	3.08	3.38	0.25	0.07	0.07	5.09	0.37	0.37	
1.37	0.79	0.17	0.54	0.21	0.06	0.09	0.10	0.01	0.00	0.00	0.15	0.01	0.01	
0.13	0.04	0.03	0.01	0.02	0.01	0.00	0.00	0.00	0.02	0.01	0.01	0.57	0.03	
2.06	1.18	0.26	0.81	0.31	0.08	0.14	0.15	0.01	0.00	0.00	0.22	0.02	0.02	
0.19	0.07	0.04	0.01	0.03	0.01	0.00	0.00	0.00	0.03	0.01	0.01	0.85	0.04	
0.02958249	0.016925	0.00375938	0.011587815	0.00444445	0.00120878	0.00194571	0.00213478	0.00016142	6.81459E-05	5.71806E-05	0.003216092	0.0009419	0.00026628	0.07629942

Table D3.5-33. GHG Emissions, Engine Tests, Rickenbacker, Proposed Action

Aircraft/Test Type	Number of Engine Tests	Power Setting	Duration (hrs)	Number of Engines	Fuel Flow Rate per Engine (lbs fuel/hr)	Emission Factor(1)			Actual Emissions (lb/yr)		
						CO2 (lb/1000 lb fuel)	CH4 (lb/1000 lb fuel)	N2O (lb/1000 lb fuel)	CO2	CH4	N2O
KC-46A											
Defueling	17	Idle	0.50	1	1,663	3,216.0	0.1	0.1	45,465.24	1.26	1.41
Maintenance Run	68	Idle	0.33	2	1,663	3,216.0	0.1	0.1	242,481.25	6.71	7.54
TRT Run 2 Engine	8	Idle	0.17	1	1,663	3,216.0	0.1	0.1	7,131.80	0.20	0.22
	8	80% RPM	0.08	1	16869.6	3,216.0	0.1	0.1	36,168.42	1.00	1.12
TRT Run 4 Engine	6	Idle	0.17	2	1,663	3,216.0	0.1	0.1	10,697.70	0.30	0.33
	6	80% RPM	0.08	2	16869.6	3,216.0	0.1	0.1	54,252.63	1.50	1.69
Total, tpy									180	0.00	0.01

(1) CO2 emission factors obtained from AFCEC 2013.
CH4 and N2O emission factors were derived from Table A-101 for jet fuel in EPA's Inventory of U.S. Greenhouse Gas Emissions and Sinks, 1990-2005, using density of JP-8 as 6.8 lb/gallon.

Table D3.5-34. Rickenbacker Comparison of Emissions

	Annual Emissions, tons/year					
Baseline	VOC	CO	NOx	SO2	PM10	PM2.5
Aircraft Ops	4.63	68.57	64.35	6.38	0.34	0.34
AGE	0.01	0.02	0.15	0.00	0.01	0.01
Engine Tests	0.11	1.55	0.43	0.07	0.01	0.01
POVs	4.55	67.35	3.55	0.05	0.15	0.07
Total	9.29	137.50	68.48	6.50	0.51	0.42
Proposed Action	VOC	CO	NOx	SO2	PM10	PM2.5
Aircraft Ops	21.73	77.82	123.58	7.78	0.57	0.49
AGE	0.01	0.02	0.15	0.00	0.01	0.01
Engine Tests	0.59	2.03	0.54	0.07	0.01	0.01
POVs	4.09	60.59	2.68	0.05	0.15	0.07
Total	26.43	140.46	126.95	7.90	0.73	0.57
Net Increase	17.13	2.96	58.47	1.40	0.23	0.15

Table D3.5-35. Rickenbacker Comparison of HAP Emissions

	Annual HAP Emissions, tons/year													
Baseline	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
Aircraft Ops	0.23	0.00	0.00	0.01	0.01	0.03	0.00	0.01	0.00	0.01	0.00	0.00	0.29	0.02
AGE	0.03	0.02	0.00	0.00	0.02	0.01	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00
Engine Tests	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	0.26	0.02	0.00	0.01	0.03	0.04	0.00	0.01	0.00	0.01	0.00	0.00	0.29	0.02
Proposed Action	Form-aldehyde	Acet-aldehyde	Acrolein	Naphthalene	Benzene	Toluene	Ethyl-benzene	Xylenes	Styrene	Chloroform	Chloromethane	1,3-Dichloropropene	Methylene Chloride	Vinyl Acetate
Aircraft Ops	3.10	1.07	0.62	0.14	0.42	0.16	0.04	0.07	0.08	0.01	0.01	0.00	0.31	0.02
AGE	0.03	0.02	0.00	0.00	0.02	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Engine Tests	0.03	0.02	0.00	0.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	3.15	1.11	0.62	0.15	0.45	0.17	0.05	0.07	0.08	0.01	0.01	0.01	0.31	0.02
Net Increase	2.89	1.09	0.62	0.14	0.42	0.13	0.04	0.06	0.07	0.00	0.00	0.00	0.02	0.00

Table D3.5-36. Rickenbacker Comparison of GHG Emissions

	Annual GHG Emissions, metric tons/year			
Baseline	CO2	CH4	N2O	CO2e
Aircraft Ops	17562	0.49	0.55	17742
AGE	3298	0.09	0.11	3333
Engine Tests	183	0.01	0.01	185
POVs	2407	0.00	0.00	2407
Total	23451	0.58	0.66	23667
Proposed Action	CO2	CH4	N2O	
Aircraft Ops	21009	0.53	0.60	21206
AGE	3291	0.09	0.11	3326
Engine Tests	180	0.00	0.01	182
POVs	2430	0.00	0.00	2430
Total	26909	0.63	0.71	27143
Net Increase	3458	0.05	0.05	3476

Appendix E

Special Status Species Lists

APPENDIX E SPECIAL STATUS SPECIES LISTS

Special Status Species Observed or Potentially Occurring in the Vicinity of Forbes ANGS

Common Name	*Scientific Name*	*Status*	*Occurrence on Forbes Field Airport*
Birds			
Eskimo Curlew	*Numenius borealis*	FE, SE	U
Least Tern	*Sternula antillarum*	FE, SE	U
Piping Plover	*Charadrius melodus*	FT, ST	U
Snowy Plover	*Charadrius alexandrinus*	ST	U
Whooping Crane	*Grus americana*	FE, SE	U
Mammals			
Eastern spotted skunk	*Spilogale putorius*	ST	U
Amphibians and Reptiles			
Smooth earth snake	*Virginia valeriae*	ST	U
Fish			
Silver chub	*Macrhybopsis storeriana*	SE	U
Sturgeon chub	*Macrhybopsis gelida*	FC, ST	U
Topeka shiner	*Notropis topeka*	FE, ST	U
Invertebrates			
American burying beetle	*Nicrophorus americanus*	FE, SE	U

Notes: FT = Federal Threatened, FE = Federal Endangered, FC = Federal Candidate, ST = State Threatened, SE = State Endangered, U = Unlikely

Sources: 190th Air Refueling Wing 2004; Kansas Department of Wildlife, Parks and Tourism 2005, 2013.

Special Status Species Observed or Potentially Occurring in the Vicinity of JB MDL

Common Name	*Scientific Name*	*Federal Status/State Status*	*Occurrence On McGuire Field*
Birds			
American Bittern	*Botaurus lentiginosus*	SE	P
American Kestrel	*Falco sparverius*	ST	O
Bald Eagle	*Haliaeetus leucocephalus*	ST/SE	P
Barred Owl	*Strix varia*	ST	P
Black-crowned Night Heron	*Nycticorax nycticorax*	ST	P
Grasshopper Sparrow	*Ammodramus savannarum*	ST	O
Henslow's Sparrow	*Ammodramus henslowii*	SE	P
Horned Lark	*Eremophila alpestris*	ST	P
Long-eared Owl	*Asio otus*	ST	P
Northern Goshawk	*Accipiter gentilis*	SE	P
Northern Harrier	*Circus cyaneus*	SE	O
Osprey	*Pandion haliaetus*	ST	P
Pied-billed Grebe	*Podilymbus podiceps*	SE	O
Red-headed Woodpecker	*Malanerpes erythrocephalus*	ST	P
Red-shouldered Hawk	*Buteo lineatus*	ST/SE	P
Savannah Sparrow	*Passerculus sandwichensis*	ST	O
Sedge Wren	*Cistothorus platensis*	SE	P
Upland Sandpiper	*Bartramia longicauda*	SE	O
Vesper Sparrow	*Pooecetes gramineus*	SE	P
Mammals			
Bobcat	*Lynx rufus*	SE	P
Amphibians and Reptiles			
Bog turtle	*Clemmys muhlenbergii*	FT, SE	P
Corn snake	*Elaphe guttata*	SE	P
Eastern mud salamander	*Pseudotriton montanus montanus*	ST	P
Northern pine snake	*Pituophis melanoleucus melanoleucus*	ST	P
Southern gray treefrog	*Hyla chrysoscelis*	SE	P
Timber rattlesnake	*Crotalus horridus*	SE	P
Pine Barrens treefrog	*Hyla andersonii*	ST	P
Wood turtle	*Glyptemys insculpta*	ST	P
Invertebrates			
Arogos skipper	*Atrytone arogos*	SE	P
Frosted elfin	*Callophrys irus*	ST	P
Silver-bordered fritillary	*Boloria selene*	ST	P
Plants			
American chaffseed	*Schwalbea americana*	FE, SE	P
Bog (Yellow) asphodel	*Narthecium americanum*	C, SE	P
Knieskern's beaked-rush	*Rhynchospora knieskernii*	FT, SE	P
Swamp pink	*Helonias bullata*	FT, SE	P

Notes: FE = Federally Endangered, FT = Federally Threatened, C = Candidate Species, SE = State Endangered, ST = State Threatened, P = Potential, O = Observed

Source: 87th Civil Engineer Squadron 2012, Air Mobility Command 2008, New Jersey Department of Environmental Protection 2013.

Special Status Species Observed or Potentially Occurring in the Vicinity of Pease ANGS

Common Name	*Scientific Name*	*Federal Status/State Status*	*Occurrence On Portsmouth International Airport*
Birds			
Bald Eagle	*Haliaeetus leucocephalus*	ST	O
Common Loon	*Gavia immer*	ST	O
Common Nighthawk	*Chordeiles minor*	SE	O
Common Tern	*Sterna hirundo*	ST	O
Northern Harrier	*Circus cyaneus*	SE	O
Peregrine Falcon	*Falco peregrinus*	ST	O
Upland Sandpiper	*Bartramia longicauda*	SE	O
Mammals			
New England cottontail	*Sylvilagus transitionalis*	C, SE	P
Amphibians and Reptiles			
Blanding's turtle	*Emydoidea blandingii*	SE	P
Plants			
Large bur-reed	*Sparganium eurycarpum*	ST	P
Northern blazing star	*Liatris scariosa* var. *novae-angliae*	SE	P
Seaside mallow	*Hibiscus moscheutos*	SE	P
Small whorled pogonia	*Isotria medeoloides*	FT, ST	U

Notes: FT = Federally Threatened, C = Candidate Species, SE = State Endangered, ST = State Threatened, O = Observed, P = Potential; U = Unlikely

Source: 157th Air Refueling Wing 2013, New Hampshire Fish and Game 2013, New Hampshire Natural Heritage Bureau 2013.

Special Status Species Observed or Potentially Occurring in the Vicinity of Pittsburgh ANGS

Common Name	*Scientific Name*	*Federal Status/State Status*	*Occurrence On Pittsburgh International Airport*
Birds			
Short-eared Owl	*Asio flammeus*	SE	P
Northern Harrier	*Circus cyaneus*	ST	P
Peregrine Falcon	*Falco peregrinus*	SE	P
Bald Eagle	*Haliaeetus leucocephalus*	ST	P
Migrant Loggerhead Shrike	*Lanius ludovicianus migrans*	SE	P
Mammals			
Indiana bat	*Myotis sodalis*	FE	P
Amphibians and Reptiles			
Northern cricket frog	*Acris crepitans*	SE	P
Kirtland's snake	*Clonophis kirtlandii*	SE	P
Eastern massasauga	*Sistrurus catenatus catenatus*	C, SE	P
Fish			
Warmouth	*Chaenobryttus gulosus*	SE	U
Ghost shiner	*Notropis buchanani*	SE	U
Bluebreast darter	*Etheostoma camurum*	ST	U
Tippecanoe darter	*Etheostoma tippecanoe*	ST	U
Southern redbelly dace	*Phoxinus erythrogaster*	ST	U
Plants			
Northern water plantain	*Alisma triviale*	SE	P
Scarlet ammannia	*Ammannia coccinea*	SE	P
Carey's sedge	*Carex careyana*	SE	P
Cattail sedge	*Carex typhina*	SE	P
Vasevine leather-flower	*Clematis viorna*	SE	P
Small yellow lady's-slipper	*Cypripedium parviflorum* var. *parviflorum*	SE	P
Tall larkspur	*Delphinium exaltatum*	SE	P
Common shootingstar	*Dodecatheon meadia*	SE	P
Four-angled spike-rush	*Eleocharis quadrangulata*	SE	P
Cluster fescue	*Festuca paradoxa*	SE	P
Bicknell's hoary rockrose	*Helianthemum bicknellii*	SE	P
Purple rocket	*Iodanthus pinnatifidus*	SE	P
Crested dwarf iris	*Iris cristata*	SE	P
Forked rush	*Juncus dichotomus*	SE	P
American gromwell	*Lithospermum latifolium*	SE	P
Large-flowered marshallia	*Marshallia grandiflora*	SE	P
Oblique milkvine	*Matelea obliqua*	SE	P
Spotted beebalm	*Monarda punctata*	SE	P
Northern watermilfoil	*Myriophyllum exalbescens*	SE	P
Round hickorynut	*Obovaria subrotunda*	SE	P
False gromwell	*Onosmodium molle*	SE	P
Passionflower	*Passiflora lutea*	SE	P
Balsam poplar	*Populus balsamifera*	SE	P
Tennessee pondweed	*Potamogeton tennesseensis*	SE	P
Crepis rattlesnake-root	*Prenanthes crepidinea*	SE	P

Special Status Species Observed or Potentially Occurring in the Vicinity of Pittsburgh ANGS

Common Name	Scientific Name	Federal Status/State Status	Occurrence On Pittsburgh International Airport
Eastern blue-eyed grass	*Sisyrinchium atlanticum*	SE	P
Wild hyacinth	*Triteleia hyacinthina*	ST	P
Harbinger of spring	*Erigenia bulbosa*	ST	P
Torrey's rush	*Juncus torreyi*	ST	O
Common hoptree	*Ptelea trifoliata*	ST	P
Limestone petunia	*Ruellia strepens*	ST	P
Invertebrates			
Sheepnose mussel	*Plethobasus cyphyus*	FE, ST	U
Snuffbox	*Epioblasma triquetra*	SE	U
Gravel chub	*Erimystax x-punctatus*	SE	U
Rabbitsfoot	*Quadrula cylindrica*	C, SE	U
Pistolgrip mussel	*Quadrula verrucosa*	SE	U

Notes: FE = Federally Endangered, C = Candidate Species, SE = State Endangered, ST = State Threatened, O = Observed, P = Potential; U = Unlikely

Source: Pennsylvania Natural Heritage Program 2013, 171st Air Refueling Wing 2012.

Special Status Species Observed or Potentially Occurring in the Vicinity of Rickenbacker ANGS

Common Name	*Scientific Name*	*Status*	*Occurrence on Rickenbacker International Airport*
Birds			
Short-eared Owl	*Asio flammeus*	SE	P
Northern Harrier	*Circus cyaneus*	SE	O
Barn Owl	*Tyto alba*	ST	P
Peregrine Falcon	*Falco peregrinus*	FSC, ST	P
Upland Sandpiper	*Bartramia longicauda*	SE	P
Bald Eagle	*Haliaeetus leucocephalus*	ST	P
Migrant Loggerhead Shrike	*Lanius ludovicianus migrans*	SE	P
Mammals			
Indiana bat	*Myotis sodalis*	FE, SE	P
Amphibians and Reptiles			
Kirtland's snake	*Clonophis kirtlandii*	SE	P
Eastern massasauga	*Sistrurus catenatus catenatus*	C, SE	P
Fish			
Warmouth	*Chaenobryttus gulosus*	SE	U
Gravel chub	*Erimystax x-punctatus*	SE	U
Ghost shiner	*Notropis buchanani*	SE	U
Bluebreast darter	*Etheostoma camurum*	ST	U
Tippecanoe darter	*Etheostoma tippecanoe*	ST	U
Southern redbelly dace	*Phoxinus erythrogaster*	ST	U
Invertebrates			
Snuffbox	*Epioblasma triquetra*	FE, SE	U
Rabbitsfoot	*Quadrula cylindrica*	C, SE	U
Pistolgrip mussel	*Quadrula verrucosa*	SE	U
Sheepnose mussel	*Plethobasus cyphyus*	FE, ST	U
Plants			
Gattinger's-foxglove	*Acorus americanus*	ST	P
Spreading rockcress	*Arabis patens*	SE	P
Northern water plantain	*Alisma triviale*	SE	P
Scarlet ammannia	*Ammannia coccinea*	SE	P
Carey's sedge	*Carex careyana*	SE	P
Cattail sedge	*Carex typhina*	SE	P
Vasevine leather-flower	*Clematis viorna*	SE	P
Small yellow lady's-slipper	*Cypripedium parviflorum* var. *parviflorum*	SE	P
Tall larkspur	*Delphinium exaltatum*	SE	P
Common shootingstar	*Dodecatheon meadia*	SE	P
Four-angled spike-rush	*Eleocharis quadrangulata*	SE	P
Cluster fescue	*Festuca paradoxa*	SE	P
Bicknell's hoary rockrose	*Helianthemum bicknellii*	SE	P
Purple rocket	*Iodanthus pinnatifidus*	SE	P
Crested dwarf iris	*Iris cristata*	SE	P
Forked rush	*Juncus dichotomus*	SE	P
American gromwell	*Lithospermum latifolium*	SE	P

Special Status Species Observed or Potentially Occurring in the Vicinity of Rickenbacker ANGS

Common Name	*Scientific Name*	*Status*	*Occurrence on Rickenbacker International Airport*
Large-flowered marshallia	*Marshallia grandiflora*	SE	P
Oblique milkvine	*Matelea obliqua*	SE	P
Spotted beebalm	*Monarda punctata*	SE	P
Northern watermilfoil	*Myriophyllum exalbescens*	SE	P
Round hickorynut	*Obovaria subrotunda*	SE	P
False gromwell	*Onosmodium molle*	SE	P
Passionflower	*Passiflora lutea*	SE	P
Balsam poplar	*Populus balsamifera*	SE	P
Tennessee pondweed	*Potamogeton tennesseensis*	SE	P
Crepis rattlesnakeroot	*Prenanthes crepidinea*	SE	P
Eastern blue-eyed grass	*Sisyrinchium atlanticum*	SE	P
Wild hyacinth	*Triteleia hyacinthina*	ST	P
Harbinger of spring	*Erigenia bulbosa*	ST	P
Torrey's rush	*Juncus torreyi*	ST	P
Common hoptree	*Ptelea trifoliata*	ST	P
Limestone petunia	*Ruellia strepens*	ST	P

Notes FT = Federal Threatened, FE = Federal Endangered, FC = Federal Candidate, ST = State Threatened, SE = State Endangered, O = Observed, P = Potential, U = Unlikely; FSC = Federal Species of Concern

Sources: Ohio Department of Natural Resources 2012; United States Fish and Wildlife Service 2005, 2010.

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